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ABSTRACT

This manual discusses the latest (and some not so recent) educational technologies used in classrooms, provides instructions for using them, and offers suggestions as to how they might be used more effectively. The following technologies are included: printed word, black and white chalkboards, overhead projectors, telephone instruction, facsimile transmission, audiotape recordings, 35mm slide projectors, 16mm projectors, video equipment, microcomputers, and video conferencing. Included in each discussion is a description of the equipment, suggested presentation techniques, and advantages and disadvantages of the medium. Diagrams and references are provided throughout the document, and a glossary of terms is attached. (DB)

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TECHNOLOGIES FOR TEACHING

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Diagrams provided by Nanette Mercer and Peter Bushell

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FOREWORD

Only about 15 years ago I remember an eminent Vice-Chancellor attempting to "project" his lecture notes from an overhead projector to a screen. He was totally perplexed, wondering why opaque paper produced a black image on the screen instead of his typewritten notes. Fortunately, those days have now gone; although arm-waving in front of the screen, instead of placing a pencil on top of the transparency, is still very common. It is hoped that this handbook will help to stop arm-waving and correct other gross errors of presentation!

'Technologies for teaching' covers the complete range of commonly available teaching technologies. Because the oldest and most common of these (printed notes and the chalkboard) are consistently badly used, they have been included. For example, chalkboards are frequently employed as giant scribbling pads; and the whiteboard has resurfaced as a piece of modern technology because of being attached to an electronic copying machine and a motor to turn the board.

Because most TAFE teachers are interested in **how** things work, brief descriptions of the equipment are given, as well as how to use it. To get the best out of equipment teachers should ask themselves questions like the following:

> Are the course objectives more readily attained by using the technology?
>
> Will students benefit?
>
> Will there be an overall saving in time?
>
> Are there likely to be overall cost benefits?
>
> Will the use of the technology make the course more "open"?
>
> Will it make teaching easier?

Technology is a means to an end, not an end in itself. Those who use this book will be helped to make sensible decisions affecting their teaching.

William C. Hall
Adelaide, 1991

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1. THE PRINTED WORD

Despite the wide range of technologies which are available to today's teachers and learners print remains the most important.

Print has some crucial advantages over any other medium for storing and transmitting ideas and information.

- Print is almost completely independent of the need for a power source other than lighting. At a pinch you can even read print by candlelight!
- Print is high portable. Books fit into pockets, backpacks, briefcases and gloveboxes. They do not buckle if left in a car in the sun. They do not lose their data if exposed to electromagnetic radiation. They are not tied to any particular data operating system.
- Print always matches the pace of the user. It does not race ahead of the slow reader or lag behind the speed reader. It always waits while you think things over.
- Cross referencing in print is easy. You can look at several pages one beside the other or quickly flick back-and-forth between pages.
- Most people have learned the skills of using print at an early age and can use anything in print provided that it is written in a language that they know. They do not need to learn how to run new programs or operating systems.

This list could go on. But that is not to say that print has not been affected by changes in technology. In fact changes in technology have made print even more useful and useable than it was in the days when the printing press first came into common use.

Now you can take advantage of word processors, desk top publishing facilities, high speed photocopiers, simple to use stencil duplicators, off-set printing and so on to employ print more effectively and flexibly than ever.

In this chapter we are going to look at print from two sides. First, the writing of the text, then its presentation in print.

WRITING THE TEXT

RULE ONE: AIM FOR SIMPLICITY

For the kind of writing we do as teachers there is one basic rule: aim for simplicity.

This does not mean that we should over simplify things that are complicated by nature but that our presentation should not add unnecessary complications. This applies to the way we write and to the way we present our text - that is to our **style** and to our **graphic design**. Both of these are things which need thought and effort if we are to get them right.

STYLE

Style is something we find in all human activity. Anything which it is humanly possible to do can usually be done in more than one way. The difference is what we call style.

Writing is no exception to this rule. Each writer has a personal style, sometimes so distinctive that you can recognise the author from a piece of writing on which no name appears.

In your writing you will have a style already, one that has developed over many years. But in writing for students you need to make a conscious effort to ensure that your style is appropriate. You do not have to lose your individuality but you do have to make sure that what you write is clear and concise.

The harder it is for someone to get to the heart of what someone is writing the less likely they are to finish reading it, let alone to understand it or learn from it.

There are a number of things to focus on when you are writing for students.

Sentence Length

Short sentences are easier to get right than long ones. They are also easier for the reader to follow.

Writing long and complicated sentences places far too many demands on both writer and reader. Consider the following sentences for example.

> *The skilled navigator, that is one who is able to choose and follow the most efficient route between two points, be they on land or at sea, must be able to use the compass correctly: failure to do so may lead to no more than temporary geographic embarrassment but, if conditions are extreme or distances great, it may lead to disaster, to the death of the erring navigator and to any unfortunate folk who have entrusted themselves to her care.*
>
> *Before you set out on your course make sure that you orient your map correctly; make sure that north on the map, which should be at the top of the page, corresponds with north in the world around you and, keeping the map so oriented, turn yourself to face in the direction in which you intend to travel.*

With careful reading and re-reading you may be able to work out what they mean. The writing is certainly grammatically correct. But is this the best way to explain about skills of navigation? And what about a sentence of a similar length from the pen of someone less skilled.

> *When you have to go across a big area which doesn't have many obvious landmarks like big hills or roads especially if the visibility is poor say in a forest or even in the fog then you need to use your compass in a way that may not get you there by the shortest route but does get you there safely for instance aiming off for a long catching feature or pace counting so that you do not go too far.*

Not only is there no punctuation here but also the information is poorly organised and incomplete. Poor punctuation and poor organisation are the two most common traps for the writer who lets sentence length get out of control.

This does not mean that only short sentences should be used. Far from it. Writing in which nothing but short sentences are used can appear childlike, even an insult to the intelligence of the reader. Vary your sentence length as I am doing in this paragraph. You can even use quite long and complicated sentences on occasions as long as you do not let them get out of control; when you do use them pay close attention to their organisation and punctuation.

Organisation

What you write must be logical and well organised.

To achieve this you need to spend time in planning what to write and, when you have written it, in editing it. At the planning stage you must work out the logic of what needs to be known first, what follows from that and so on. At the editing stage you need to check that what you have written makes the sense that you intended.

These days the ready availability of word processors makes the editing stage a relatively painless process. You can add words, delete words and rearrange words at the touch of a few keys or the manouvering of a mouse. You do not have to go through pages and pages of first and second and third drafts as you struggle to express yourself clearly and succinctly.

EDITING

However, if you are working on an extended piece of work that will be many pages long there is nothing which you can do which is as effective as having someone else read through your text. This may be a professional editor, a colleague with a background in the matters which you have written about or a person with no such background but whom you feel should be able to understand what you have written if you have got it right. Professional writers often make use of at least two of these alternatives.

If you are writing educational materials for publication you should make it a matter of routine to use the two steps of **content editing** and **copy editing**.

Content editing involves having your manuscript read by someone who is also an expert in your field to make sure that your handling of the content is satisfactory. The content editor reads your manuscript then comes back to you with queries or suggestions which you both discuss before you decide what should go in the final text. (**Manuscript** literally means **hand written** but these days the document in question would more likely be a draft off your word processor.)

Copy editing is a technical task relating to formalities of style and presentation, mundane but critical matters such as spelling and more complex issues like the internal consistency of what you have written. Copy editing is a job for professionals who are trained and experienced in these requirements for any publication.

If your writing is not at the scale where it is necessary to call in outside assistance you should still go through the editing process yourself as you **work through successive**

drafts of your text. At the individual level that is what the writing of first, second and subsequent drafts of a text is all about - checking all aspects of what you have written to make sure that they are as close to perfect as you can get them.

One way to make this process more effective, if you have time, is to leave the manuscript for a few days before you come back to check it. This especially applies to content editing. If you re-read what you have written straight after you write it then it is quite likely that you will read it as though it says what you meant to say even when it does not. The reason for this is that what you meant to say is still fresh in your mind. You are likely to overlook faults that will be much more obvious to you after a few days break.

FURTHER READING

There are many books and courses available which give detailed advice about how to tackle the writing process. You should consult one or more of these if you feel that you are in need of further development in these skills.

Remember though that there is no substitute for practice. You will improve your writing by writing, re-reading and rewriting.

PRINTING THE TEXT - GRAPHIC DESIGN

In the age of the word processor, laser printer and fast photocopier we all have the opportunity to present our texts in formats which would have been out of the question five to ten years ago. We also have the opportunity to do a lot of the basic print production for ourselves.

However there is the danger that we will use the technology poorly. The speed of the computer and the photocopier means that what we do badly we can very quickly distribute widely. It is far better to make sure that we get it right before we publish.

If you were having your text put to print by professionals you would have the advantage of advice from experts of all kinds from copy editors to graphic designers. If you are involved in writing something substantial for large volume publication you should be using such services regardless of the technology that might be available to you. No computer has been programmed with such things as good taste, appreciation of style or an understanding of what makes for effective reading. This is human knowledge which is only available from human experts.

For example the word processing programs on modern computers give you access to a wide range of fonts, styles and sizes. *It is far too easy to let this go to your head,* as I have done in this paragraph. The computer will do whatever you tell it to do. It will not tell you that you are producing something which is unreadable.

While you are not likely to do anything as extreme as I have done in the previous paragraph it will help you to make your text readable if you follow a few simple rules.

RULE TWO: AIM FOR SIMPLICITY

You will notice that Rule 2 is the same as Rule 1. Above all else in graphic design it is vital that you do not hide your message in unnecessary decorations.

Design for meaning, not for irrelevant visual impact.

To do this you need to consider the page, the column and the font. You need to consider them separately and as they relate to one another.

THE PAGE

Since we are talking about print production which you are basically doing yourself we need only consider the most widely used paper sizes in teaching institutions. These are A3, A4 and A5. Of these A4 is by far the most common; it is the size of most writing pads for example. A4 page size has been used for this book.

You have probably noticed that these sheets all have the same proportions and that A3 folded in half lengthwise becomes A4 while A4 folded the same way becomes A5. This adds scope to what you can do by way of expansion or reduction of things which you have prepared for print.

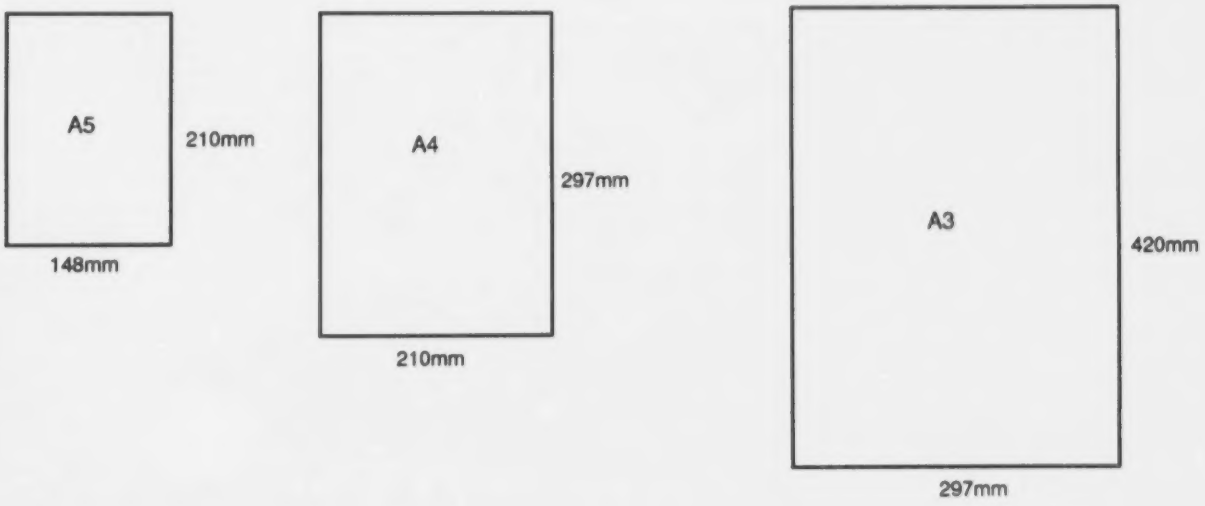

Figure 1.1 Paper sizes

Starting with the blank page you have two choices of format.

Figure 1.2 Page formats

So your first two decisions must be:

What size of paper shall I use?

Which format shall I use?

Page Size

Since most folders which students use are A4 size the most convenient paper size for them is A4. You need a very good reason to go away from this. The most common justification for going to A3 is the need for extra space to fit in graphics: maps, diagrams or plans for example which cannot be compressed into A4 and remain readable. Going to A5 is rarely needed for teaching material but can be a very attractive size for newsletters or course information leaflets.

Page Format

Portrait is used more commonly than landscape. First, it is the format of those folders which we have already mentioned. Second, going to landscape also most likely means going to two or more columns which can make page design more complex and can make your word processing task more difficult if you are not using a package which includes setting in columns.

However landscape may be your choice for similar reasons to those which may lead to the choice of A3 - the need to fit in graphic material of various kinds.

It is best to begin with the assumption that you will use A4 in portrait format and only change from that if you find that the requirements of the job demand it.

GRAVITY - Be aware of Basic Eye Movement

In English, all European languages and many other languages around the world the words we read run from left to right and from top to bottom. This may seem obvious.

You would never consider putting the words in any other order. If you did they would not make sense.

But there is more to it than that. From the moment we begin to read we develop the habit of looking at pages of text in this way. We start at the top left hand corner and finish at the bottom right hand corner. After years of practice we do this to every page whether we are reading all the words on the page or not.

An American typographer and teacher, Edmund Arnold*, has developed a simple diagram, called the Gutenberg Diagram to illustrate the implications of this.

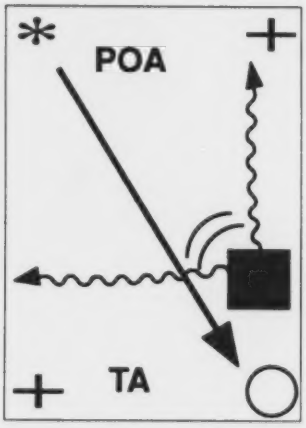

Figure 1.3 Gutenberg Diagram

According to Arnold the reader automatically looks to the top left corner which he calls the **Primary Optical Area (POA)** then follows "reading gravity" through a series of left to right sweeps towards the bottom right corner which he calls the **Terminal Anchor (TA)**. The wavy lines represent backward movements which our eyes resist. The crosses are in "fallow corners" which are likely to escape our attention.

Arnold developed this diagram by thinking about his experience as a typographer. However, research by Colin Wheildon has confirmed its general principles.

It affects us not only when we simply type up a page of text but when our page includes elements other than text.

Look at the following two figures.

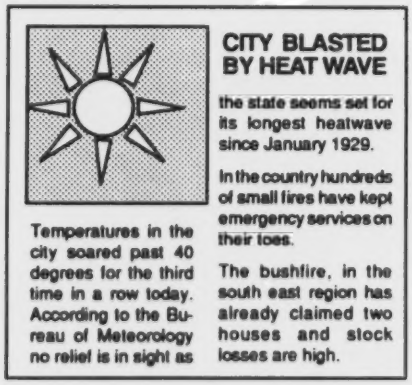
CITY BLASTED BY HEAT WAVE
the state seems set for its longest heatwave since January 1929.
In the country hundreds of small fires have kept emergency services on their toes.
Temperatures in the city soared past 40 degrees for the third time in a row today. According to the Bureau of Meteorology no relief is in sight as
The bushfire, in the south east region has already claimed two houses and stock losses are high.

Figure 1.4

* Arnold, E. C. quoted in Colin Wheildon's *Communicating or Just Making Pretty Shapes?*

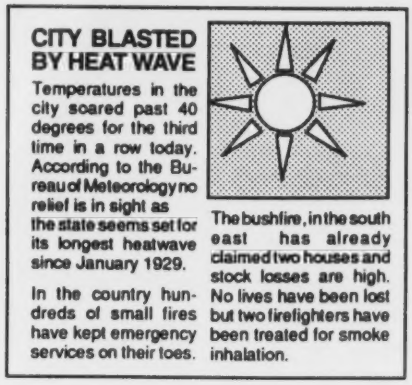
CITY BLASTED BY HEAT WAVE
Temperatures in the city soared past 40 degrees for the third time in a row today. According to the Bureau of Meteorology no relief is in sight as the state seems set for its longest heatwave since January 1929.
In the country hundreds of small fires have kept emergency services on their toes.
The bushfire, in the south east has already claimed two houses and stock losses are high. No lives have been lost but two firefighters have been treated for smoke inhalation.

Figure 1.5

In Figure 1.4 the words in each column run from left to right and down the page but the layout of the page itself breaks up the normal flow of reading. You will have looked first at the illustration then at the headline, then at the writing beneath the headline. Then you will have wondered just what the article is all about.

Figure 1.5 on the other hand gives you information straight away in the first place where you will have looked and the text then flows from there following the natural flow of reading gravity.

If you do not lay your page out in a way that reflects this natural flow of reading, no matter how 'artistic' the overall impressing may be, you will put your reader off. It won't be just a matter of the reader having a low opinion of your layout. Worse than that, Wheildon's research shows that the reader's **understanding** of the text is seriously impaired. Poor layout caused a drop from 92% of readers having a good to fair understanding to only 65%.

So when your text includes diagrams, figures, illustrations and so on you need to be very careful how you place them. Incorporate them in the natural reading flow, don't go against it.

COLUMN WIDTH

When we read we do not simply go from word to word.

Skilled readers, as most people are, can take in a whole line at a time provided that the line is not too long.

The **maximum** length with which most people seem comfortable is 15 cm but there is even more comfort with shorter lengths. (In this book we have slightly exceeded the maximum length. However, most paragraphs are short and there are numerous illustrations.)

Other ways of thinking about this are in terms of the number of words or characters in the line. Up to twelve words is very comfortable for most people. Words are very variable

however. That is why some recommend in terms of characters with up to 60 characters (include spaces as characters) being acceptable.

Remember that what lies behind all this is the reader's ability to take in a line at a time. This means that a page can be read with the minimum of left-right eye movement if the lines are not too long. The reader basically scans down the page. This process can be enhanced by the use of multiple columns as long as they fall within the specifications for reading comfort and as long as you have the facility to set your text in this way.

For the same reason very short lines, say in several narrow columns can be aggravating. Less that 20 characters of line length is not recommended.

GRAPHICS

Whenever you use diagrams there are additional considerations to those referred to in relation to reading gravity.

All diagrams should be captioned so that they are clearly identified. They should be placed in the text as close as possible to the point in the text at which this reference is made. Put the reference and the diagram on the same page unless the diagram is so large that it needs a page to itself.

If the diagram cannot be on the same page as the reference then it should be possible to look at the diagram and the text without having to flip back and forth between pages.

If you are using portrait format and the diagram will not fit, either shrink the diagram or use a fold out. This will enable the reader to look at the diagram and the text side by side.

Do not try to solve the problem by using landscape format for the diagram page. This would lead to the reader having to rotate the book each time a cross reference between text and diagram is needed thus creating another unnecessary barrier to communication and understanding.

JUSTIFYING

Wheildon also found that comprehension is improved if the text is **justified**, that is if the left and right edges are straight.

You have four options when it comes to justification:

Left justified refers to text which is set out like this. The left hand edge is straight, the right hand edge is ragged. If you are using a simple type-writer this is the only kind of justification that is realistically available to you. It can also be referred to as flush left.

Figure 1.6 Left justified

Right justified refers to text which is set out like this. The right hand edge is straight but the left hand is ragged. You may want to use this in tables but it is not at all appropriate for text. It can also be referred to as flush right.

Figure 1.7 Right justified

Centre justified or just simply centred refers to text which is set out like this. Both edges are regged and each line is placed centrally between the margins. Headings are often centred.

Figure 1.8 Centred

A text is justified when both edges are straight like this. It is achieved by varying the spaces between words or even between letters. This style of justification is standard in just about all printed text.

Figure 1.9 Justified

As long as you have the word processing technology to handle it you should justify all text where you want your students to read for meaning. On the standard typewriter where justification is far too time consuming to justify the effort you will have to fall back on flush left with ragged right edges.

You should only use centring and flush right in special circumstances such as headings. They can be effective eye catchers for small chunks of the text but are real distracters for the main body.

THE LETTERS - Fonts, Sizes and Styles

One of the major points made by Wheildon is that use of serif fonts leads to far greater understanding of the text than use of sans serif.

A font is a style of lettering. Fonts are referred to by names which sometimes give you a clue what they look like but more often do not. Two of the fonts with which you are probably most familiar are **Courier** which has been widely used on typewriters and **Times** which has been widely used in newspapers and books.

Serif fonts have thick and thin strokes and terminal serifs as illustrated in Figure 1.10.

KLMNOP12
opqrstuvwxy

Figure 1.10 Palatino, a serif font

Sans serif fonts have strokes of almost uniform thickness and have no serifs as illustrated in Figure 1.11.

KLMNOP12
opqrstuvwxy

Figure 1.11 Helvetica, a sans serif font

Wheildon found quite staggering differences between understanding of texts when set in serif print as opposed to the understanding of the same texts when set in sans serif.

Here is part of the results of his research.

Comprehension Level:	**Good**	**Fair**	**Poor**
Layout with serif foint	67%	19%	14%
Layout with sans serif font	12%	23%	65%

Figure 1.12 Effect of serifs on understanding

What these results in Figure 1.12 show is that with a serif font 67% of people who read a particular text had a good understanding of it while only 12% of people who read the same text, but in a sans serif font achieved the same level of understanding. Note that this refers to the font used in the body of the text, not to things like headings or captions.

From this we can conclude that use of a serif font is virtually indispensable if we want our readers to understand what we have written.

Add to this some other useful advice. Avoid using capital letters for emphasis in the body of the text. Visually a block of capitals may appear to stand out but this is more than offset by the fact that blocks of capitals are hard to read and therefore reduce comprehension. The same is true of bold.

Use of sans serif fonts, wholly capitalised words or bold lettering in headings or captions can be very effective, but keep them out of the body of your text.

It has also been found that 11 point is the optimum size for print. This can be taken as a guide. (11 point has been used in this book.) The further you go from 11 point the more the size of the print will detract from understanding. How well can you read the examples if Figure 1.13?

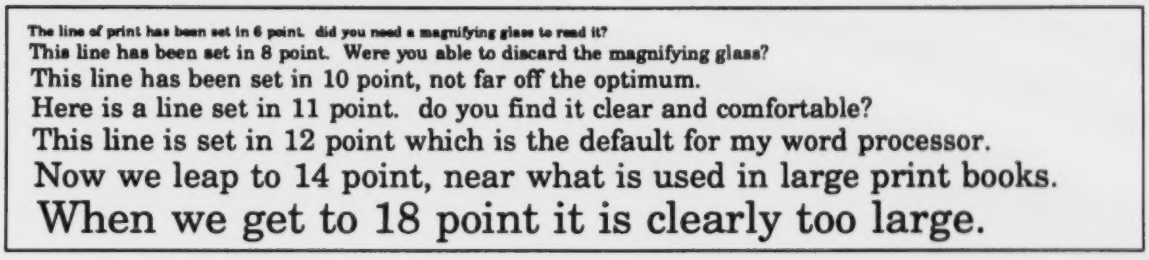
The line of print has been set in 6 point. did you need a magnifying glass to read it?
This line has been set in 8 point. Were you able to discard the magnifying glass?
This line has been set in 10 point, not far off the optimum.
Here is a line set in 11 point. do you find it clear and comfortable?
This line is set in 12 point which is the default for my word processor.
Now we leap to 14 point, near what is used in large print books.
When we get to 18 point it is clearly too large.

Figure 1.13 Various font sizes and their effects

HYPHENATION

You may be tempted to try to create the illusion that your text is justified by using excessive hyphenation. Justification is not achieved this way but by subtly varying the spaces between words and letters.

Hyphenation involves the breaking of words between one line and the next. There is a complex set of rules under which this may be done so if you want to do it you should make sure you know what the rules are*. (They are built into some advanced desk top publishing packages.)

* The most comprehensive source of advice on such matters can be found in the *Style Manual for Authors Editors and Printers*, often referred to as the Commonwealth Style Manual.

Better still, remember that hyphenation is another thing which interferes with reading flow and therefore with comprehension. Instead of wasting time trying to learn the hyphenation rules it is better simply not to do it.

COLOURS

You may wish to use coloured ink or coloured paper. If you do, get some red paper, print on it in blue and try reading what is there.

Then get some black paper and print on it in green.

A few simple experiments like these will make it clear to you that there are some very ineffective combinations of colours when it comes to reading for understanding.

Basically, black on white is best. Unimaginative perhaps, but the most comprehensible.

If you want to use coloured paper for solid blocks of text keep to light pastel shades. If you want to use coloured inks make sure that there is a good clear contrast between the ink and the paper.

WORD PROCESSING AND DESK TOP PUBLISHING PACKAGES

There are many of these currently available. The distinction between the best word processing packages and the basic desk top publishing packages is very slight.

What use you make of these will depend upon what is actually available to you and what the needs of your situation are. The best of these packages make the production of top quality material from your own desk top a real possibility. This book has been produced on a personal computer using the WordPerfect 5.1 software package.

However what you make with such packages will depend very much on your skills in writing and design. Remember the machine has the capability but **you** must have the knowledge and skill.

Above all remember Rules 1 and 2.

RULE ONE: AIM FOR SIMPLICITY

RULE TWO: AIM FOR SIMPLICITY

You want your readers to understand what you have written not merely admire the way it looks.

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2. THE BLACK & WHITE BOARD SHOW

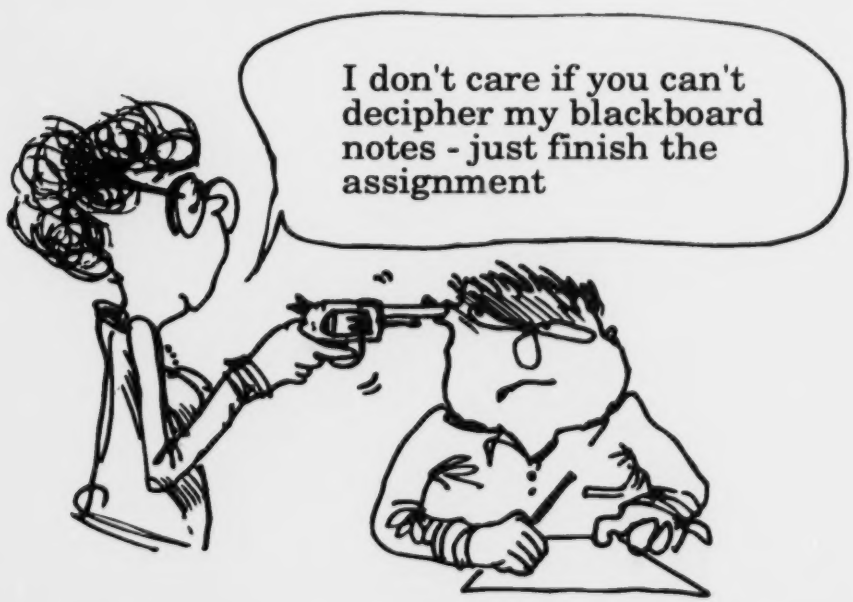
Consider the first chalkboard. A small group sheltering in a desert cave, learning the basics of kangaroo hunting. On the cave wall, an ochre diagram is being used to teach the newly initiated the intricacies of the hunt.

The chalkboard, chalk and 'chalkies' are synonymous with images of Victorian education, from the serried ranks of obedient, muted inmates to the halcyon days of exciting education with Mr Chips. The uses of black (and white) boards have expanded remarkably since those times, and their flexibility, availability and versatility are a definite boon to the classroom teacher. In these days of multi-mode media-madness, the blackboard or white board has many pluses. They are:

- freely available in most classrooms;
- need no power (except in the case of electronic whiteboards);
- user friendly (if you have chalk);
- can display a large number of colours;
- can be used with a variety of other materials for a broad range of teaching strategies.

PLANNING

Few teachers use the full potential of the chalk/white board. With judicious planning, teaching can become an exciting visual, information packed adventure which benefits both students and teacher. The main point is planning.



Writing on a black, green or white board (hereafter called the B/W Board) needs the same approach as writing any course material in a lucid, intelligent and informative way. The

first major problem is that most teachers know their subject matter *ad nauseam*. The other major problem is that the students don't.

The lines of impenetrable prose that resemble chicken scratchings are usually a barrier to learning, unless you are training pharmacists to read prescriptions. There are some very practical ways of improving your presentation and teaching powers using B/W Boards, communicating your ideas to your students, and making creative additions to your teaching lexicon.

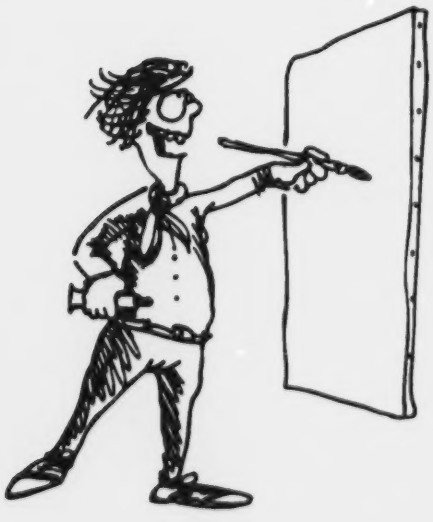
Treat your lesson as you would a book. Break the information down into sections or chapters. Use headlines and subheadings to inform your audience. Don't get bogged down into detail **unless it is essential**. The best use of a B/W Board in a classroom is to illustrate major points and concepts, not force-feed students with information which they can glean from research or reading.

With this idea in mind, **print** all information rather than scrawl (or write) it. Use large sizes of lettering for major points, using the newspaper metaphor of headlines, sub-headlines and body text - write large enough so that those at the back of the room can read the material.

Think about the architecture of your classroom where you are teaching.You should always check the lighting of the room. Is there any shine off the board from overhead or natural light (look from the student's viewpoint)? Always start a presentation with a clean board, unless you wish to prepare specific material beforehand. Prepare by writing or drawing lengthy materials on the board before the class or meeting is to start. Cover with a pull-down projection screen or paper held with tape; remove when ready to use. Clean the board carefully, using downward strokes with a duster to prevent chalk dust spreading.

Avoid chalk and talk - literally. It is very disconcerting to talk and write on the board at the same time. When speaking, look at the students, not at the board.

When you do write, face the board at right angles and move from left to right across the board, which assists in writing in a straight line. When you've finished, stand aside so that the students can then see the blackboard and read the information.



Use **colour** to point out major elements of your presentation, without overdoing the rainbow effect. Certain colours work better than others, so use colours with discretion. Yellow and white chalks work better for most information; red, dark blue and green chalk are difficult to see and erase.

As the demonstration proceeds build explanations on the board, point by point.

Place a few dots across the board in advance so that a line of writing appears level.

Use light chalk marks to place lines for guidance in drawing complex diagrams.

Use plywood or heavy cardboard templates for tracing frequently used shapes.

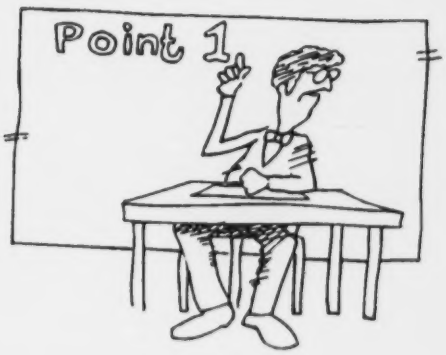
Some B/W boards are constructed for multiple use, with a metal base which will hold small magnets, pictures, word strips, and other visual materials which can be displayed. With a magnet glued to the back, the material attaches to the chalkboard. Chalk can be used to write additional material or lines can be drawn to interconnect the magnetic materials. This board is often called a magnetic chalkboard.

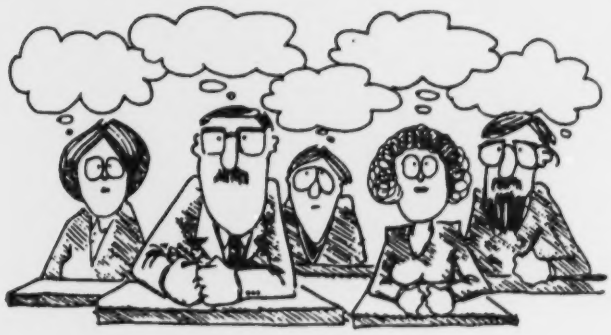
The **pounce pattern** can be used to improve the quality of your drawings on the chalkboard. If you need a chalk drawing during a presentation, make a pounce drawing by enlarging the drawing (using an opaque projector or OHP on a piece of thin posterboard, then punch holes with a sewing pattern wheel all along the lines).

Place the pattern on the chalkboard and pounce chalk dust through the tiny holes using a dusty eraser, leaving a very light pattern on the chalkboard. You can see it but the audience can't. When you need the drawing, simply connect the dots and you have prepared a neat, professional drawing.

Some blackboards have large T-squares and rulers provided. The major problem is their size, when handling them in front of a class, so try to work with them before you commence the class.

Black, green or chalk boards can also be a very creative medium. If you wish to build up a drawing or a sequence of graphics you could draw the graphics in stages and photograph, film or videotape the process, resulting in an animated sequence on slide, film or videotape. Apart from using the chalkboard as an animation tool, you can show students a sequence in "real time" and avoid having to redo the graphic each time you teach that area of your course. If the chalkboard has a white board on the other side, simply flip it over and project the sequence on that side.





Of course, all the techniques in the world won't help if you are presenting boring material in a boring way. Try to be concise, and use the old journalist's maxim - 5WH. Tell the students What, Who, Where, When, Why and How. And don't forget KISS - Keep It Simple, Stupid.

WHITEBOARDS

When is a whiteboard not a whiteboard? When it's a projection screen!

Whiteboards should have certain standards of manufacture in order to be used successfully. They should have a strong, non-scratch surface (such as vitreous porcelain or a similar surface), be low gloss (for a projection surface when required) and have a magnetic surface.

With these attributes, the whiteboard becomes a formidable teaching aid which can be used in a variety of ways.

The birth of the whiteboard was a combination of many factors, but it was virtually dragged into existence by the combination of old - and new - technologies. In the last decade, many schools and colleges have introduced white boards for the following reasons:

- Chalkboards are just that - surfaces covered with chalk dust, which may induce allergic reactions in some people, and definitely is a cleanliness problem with hands and clothes.

- Chalk dust is deadly when it confronts the decade's star innovation, the computer. A little chalk dust, being highly abrasive, can permanently ruin computer hard disks, floppies, and the insides of all sorts of delicate electronic equipment. Some computer companies in the USA even ban smoking in their buildings, so you can imagine how much more effective chalk dust would be in ruining a computer!

Whiteboards are very versatile - consider the types of material that can be used on them:

- Erasable colour markers (usually made from oil soluble resins and organic pigment inks).

- Semi-permanent markers. These are useful for drawing grids, charts and information that is required to remain whilst other writing is changed or updated.

- Self-adhesive line tapes, known as "graphic tape". These thin self-adhesive tapes can be used to draw simple outline shapes etc.

- Vinyl contact lettering. Self-adhesive letters can be used in conjunction with magnetic tapes for titling semi-permanent charts.

- Magnetic disks. These cling to the surface of the board quite tenaciously, and can be used for design or to clamp other objects to the board (similar to fridge magnets).

- Flat magnetic tapes can be used for charts and graphs, and as a base for vinyl contact lettering.

- Railed-edge magnetic tape is used in conjunction with Dymo Lettering sections, and responds in width to the 3 sizes of Dymo tapes.

- The white board can be very successfully used as a projection screen for slides, OHPs or film, allowing other information to be "overlaid" on the projected images.

With this range of graphic materials, you may find you need to be a graphic artist rather than a teacher!

Here are a few hints about using whiteboards:

- Use the correct pens with a whiteboard as some can ruin its surface.

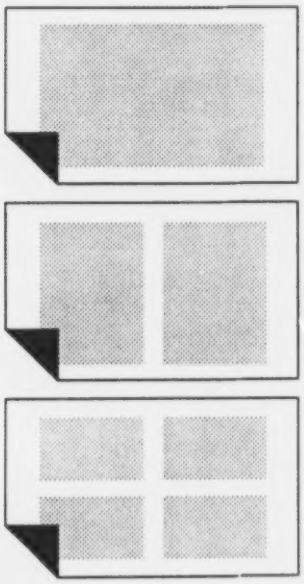
- Take care when cleaning a whiteboard. A dry cloth is often adequate but sometimes you may need to use water, detergent, or perhaps methylated spirits.

- Never use an abrasive cleaner - it may gouge the surface and do irreparable damage.

In a non-teaching environment, the white board can become a very fluid medium for the interchange of ideas. Using such a transient medium means that ideas and concepts can be visualised, discussed, and discarded without any permanent record. It also saves on paper and paper shredders!

THE ELECTRONIC WHITE BOARD

When it comes to permanence, the Electronic Whiteboard is in its element. Key points of discussion can be written on the board, refined, and then copied on to A4 size paper (up to 99 'instant' copies).



Electronic Whiteboards use a film-roll system to record images on the writing surface. The image must be created within certain parameters on the screen (about 2 cms of the frame). As the screen moves across horizontally, a new screen emerges. You can continue to write on the new frame whilst the previous frame is accessed through a thermal printing system.

Most of the Electronic Whiteboards allow at least 3 types of printed formats:

- reduction copies of 1 frame;
- 2 frames; or
- 4 frames simultaneously.

Figure 2.1 Electronic Whiteboards printed formats

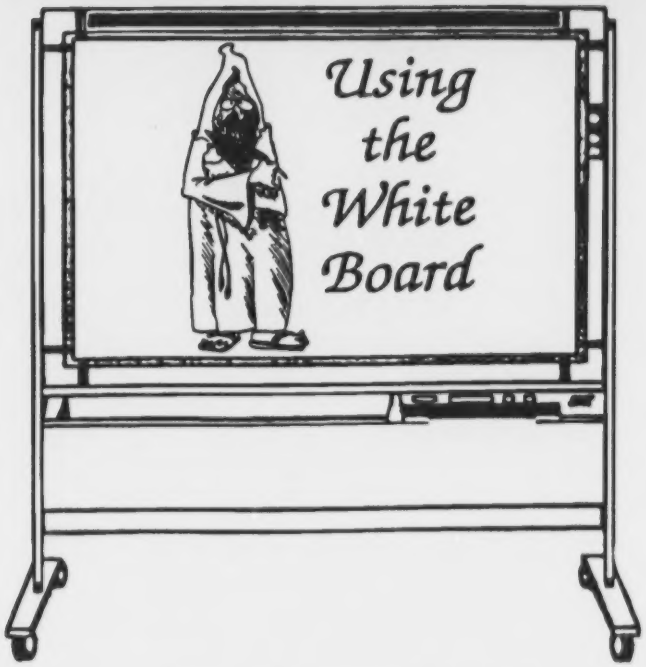


Figure 2.2 Electronic Whiteboard

Frames can be stopped at any position so you don't have to worry about frame boundaries, if making 2 frames per copy. The first copy of material on the board usually takes about 20-30 seconds, and second and successive copies about 10 seconds each. Frames can be accessed quickly by moving the writing surface backward or forward so that information can be reviewed.

All this whizzbang technology comes at a price.

The Electronic Whiteboard is very sensitive to the ambient heat or cold of a building, and there are a large number of precautions to take while using the board. They include:

- Don't place the unit in hot locations such as in direct sunlight or near heaters.
- Don't place the unit near fans or air-conditioners.
- Don't place the unit on a bumpy service which can jar the electronics.
- Don't place any adhesive tape such as cellophane tape on the white sheet.
- Don't use pins or sharp objects which will pierce the surface of the sheet.
- Don't poke or hit the whiteboard with any sharp or hard objects, as this will scratch the white frame and prevent the ink from being erased.
- Don't shake the unit while printing, to avoid poor quality copies and paper jams.
- Don't use marker pens which are not the recommended type, as they may scratch the white sheet and may not be erasable.

When finished with the Electronic Whiteboard, the image on the frame should be erased. If any material is left on the white sheet for too long, it may become un-erasable. If it does become a problem, do **not** use benzine, thinners, alcohol or spray (window cleaner) to try to remove the information, as the sheet may discolour or be damaged.

When writing on the board, use thick, dark lines as faded or thin lines will not be clearly copied. Remember, the large screen image will be reduced to A4 or less. A black marker reproduces best - red or blue lines may not be clearly copied, particularly if they are long vertical lines.

Well, that's the castlist for **THE BLACK & WHITE BOARD SHOW**. With all this range of resources, the major thing is that you know 5W/H:

- WHO you're teaching;
- WHAT you're going to teach;
- WHERE the various resources should be used - including the disadvantages;
- WHEN you should use different techniques;
- WHY you should use a chalkboard, a whiteboard or an Electronic Whiteboard; and
- HOW to use the resources effectively.

Don't forget the maxim - **planning, planning and planning**!

3. OVERHEAD PROJECTOR (OHP)

(These notes have been adapted from Bulletin 8 of the Audio Visual Education Centre, Education Department, South Australia.)

DESCRIPTION

An OHP consists of a light source, a (fresnel) lens, a glass stage to support the transparency and a series of mirrors and lenses to project an image onto a screen behind a reflector at the bottom of the machine. The light is reflected through the glass stage and the transparency and is then focused by the head assembly onto the screen.

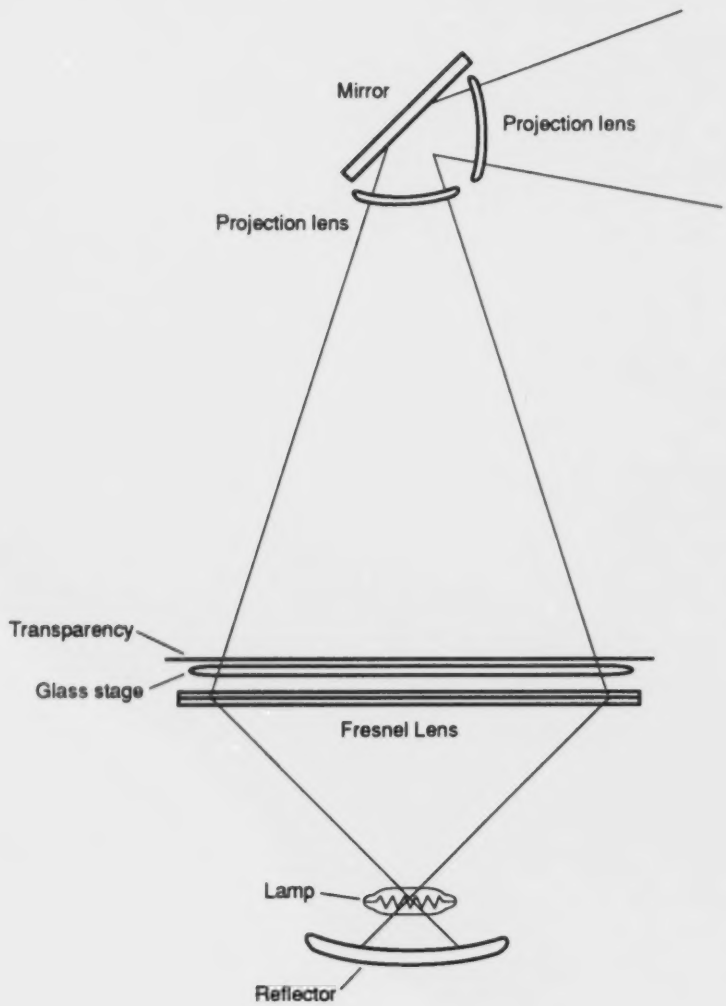


Figure 3.1 OHP optics

There are two adjustments to the OHP: the projection lens (6 & 8) can be moved up or down to focus the image; and the mirror (7) can be tilted, to shift the position of the image.

It is necessary to have a cooling fan in the OHP to prevent the heat from the lamp damaging the glass screen and the fresnel lens. It will be noticed that the light from the lamp must pass through any material on the stage of the OHP if the image on the screen is to be coloured. Thus, for coloured images, the material used must be transparent and the usual method is to write with a felt tip pen on a sheet of thin acetate.

Any opaque or translucent material (paper, cardboard, thick plastic) will show on the screen as a black shadow, because light will not pass uniformly through it. This effect can be used to advantage whenever it is necessary to demonstrate an enlarged shape or outline of a small object.

HOW TO USE IT

If there are students who have to look through or around the OHP, then it loses its effectiveness as an aid. There are several ways of overcoming this. Perhaps the three most important things to remember are:

- keep the OHP low;
- keep the screen high;
- project at an angle.

POSITION OF OHP

If the screen is placed at the front of the room it is advisable to keep the OHP low so that the students look over the top of it. A low table suits admirably to put it on, and then the teacher can sit alongside it and still use it in the normal way and still see the class.

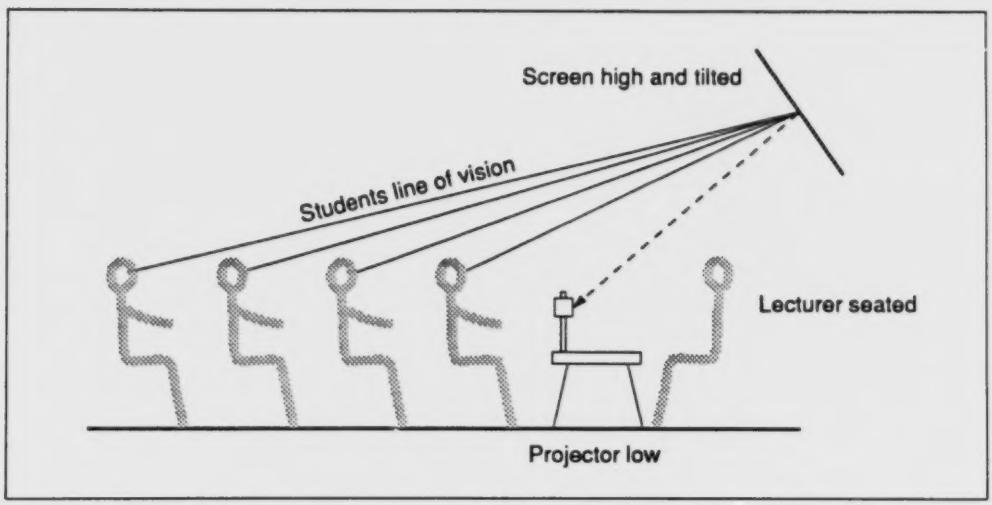


Figure 3.2 Geometry of projection

POSITION OF SCREEN

When positioning the screen it is advisable to adjust it to prevent 'keystoning'. This is caused when the light from the OHP does not strike the screen at right angles and results in the top of the image being wider than the bottom. This can be corrected by tilting the

top of the screen forward slightly. For portable screens this can be overcome by making or buying an extension arm to fit onto the top of the screen stand. If the screen is to be a fixture, then it is important to allow for this when positioning the screen, by using a set up similar to that in the diagram.

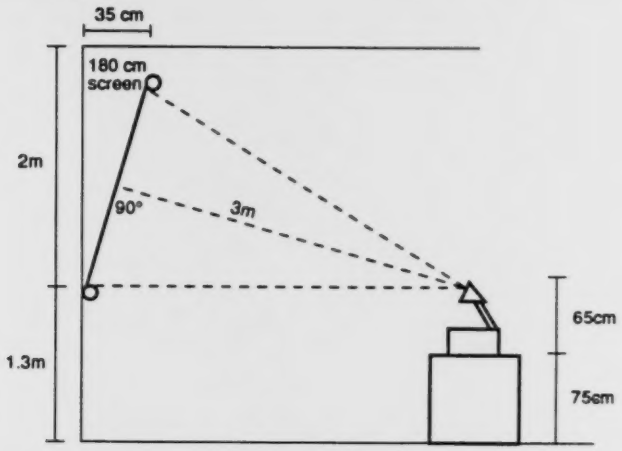


Figure 3.3

PROJECTING AT AN ANGLE

With a set up similar to that in the next diagram, it should be possible for the whole class to see the screen easily and there would be no need for the OHP to be on a low table, because it would not be an obstruction.

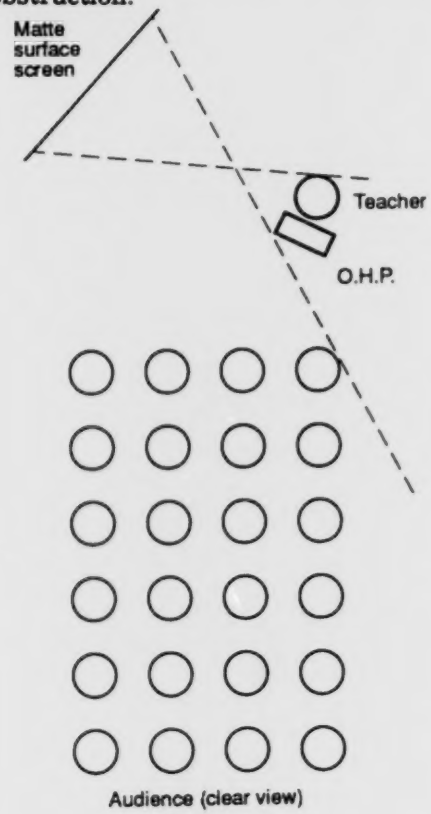


Figure 3.4

KEYSTONE EFFECT

A wedge shaped image on the screen indicates that the projector head is not parallel to the screen, and is not projecting perpendicularly onto the screen.

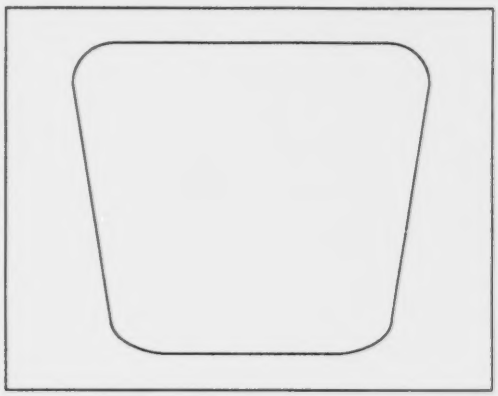


Figure 3.5

The problem can be overcome by fitting a device called a "keystone eliminator" to a portable screen, or, with a fixed screen, by attaching it so that it can be secured at the correct angle.

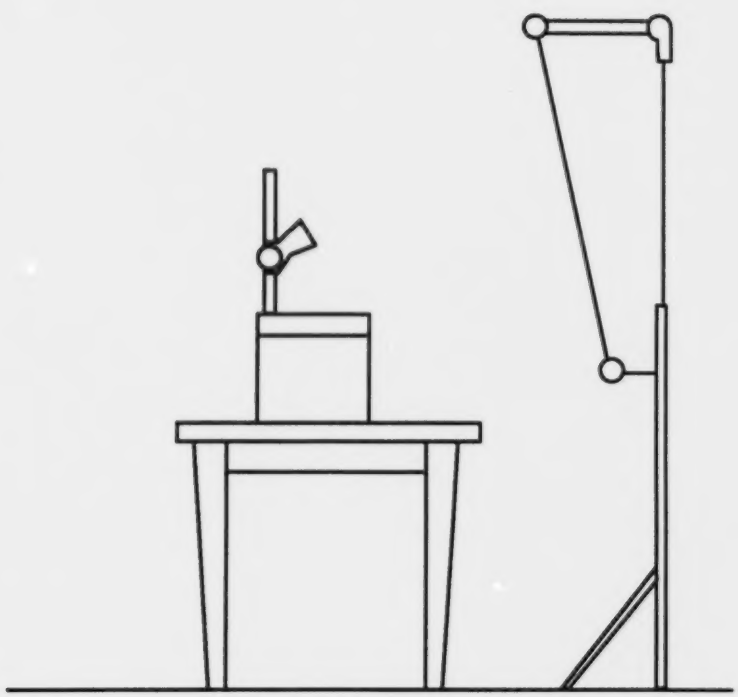


Figure 3.6

There are five rules to follow when using the OHP.

Use Revelation

Revealing projected material to a class gradually is a psychologically sound way to attract attention to the subject. There are two effective ways of revealing material - use of an opaque sheet of paper as a mask or using overlays.

Turn OHP Light On and Off

This enables the teacher to maintain complete classroom control and interest in a lesson by simply turning a switch on and off. When he or she wishes to direct student attention to the teacher the switch should be turned off. This effectively removes a source of distraction. When he/she wishes to direct attention back to the visual material, the projector should be turned on again.

Locate Transparency in Advance

It the transparency is put on the stage before the light is switched on it is relatively easy to make sure it is not upside down or back to front. This then removes the possibility of distractions.

Use Pencil for Pointer

The teacher can point to any part of the transparency without moving from the OHP by placing a pencil or similar opaque object on the transparency.

Make Notes on the Frame

Generally, there is enough space on the mounting frame of the transparency to put teaching notes. This means that the lesson material is all in one complete, compact unit. Alternatively, notes may be inserted between transparencies.

PREPARING MATERIAL

There are different ways of making transparencies, although the most common will be the first two.

Lettering Pens

Firms who sell OHPs also sell pens for making transparencies. Two main types are available - water soluble, for use on transparencies which aren't to be kept, and spirit soluble for more permanent transparencies. Because such a wide range of pens is available it is suggested that you actually test a pen on acetate to see that it gives an acceptable image. Yellow and orange pens generally do not project adequately.

Photocopiers

It is possible to photocopy material from books, type written sheets or illustrations onto special acetate sheets. It is not advisable to photocopy whole pages of text in this way because the image would be difficult to see, and there are far more effective ways of presenting information.

Transfer Letters

There are several types of adhesive letters available. Probably 'Letraset' is the best known. Remember that any transparent material will project in its true colour, any opaque material will show as black.

Heat Copiers

There is a large range of materials available for making transparencies on a heat copier. There are clear sheets with black or coloured print, colour sheets with black or colour print and opaque sheets in white or colour print. These are generally available from the firms which sell OHPs.

Cut Out Coloured Shapes

Coloured shapes can be cut from adhesive film or cellophane to make scenes etc. on a transparency.

'Lifting' Pictures From Clay Coated Paper

In this process the inks of pictures printed in colour or black and white on clay coated paper adhere to specially prepared acetate to make a transparency of the picture. First test the selected picture for clay coating by rubbing a moistened finger over a white area of the page. A white deposit on the finger indicates the presence of clay. Next, take to some clear Con-tact or Fablon and separate it from its backing sheet and carefully adhere the acetate to the face of the picture. The next step is probably the most important. It involves using a roller or similar tool to apply pressure in all directions. Take as much time as is necessary to ensure good contact between the original and the acetate. When you are sure of good contact soak the adhered picture and acetate in cool water for 3 minutes. You will then be able to peel the paper from the acetate. Remove any surplus clay from the acetate with wet cotton wool and rinse the transparency in clear water. Hang the transparency to dry or blot it with paper towelling, and then spray the picture side of the acetate with Krylon (available from art shops) to protect the image. Be careful that you follow the instructions on the tin. When the spray has dried, mount the transparency for use. You may like to place a piece of clear acetate behind the transparency when you mount it, for added protection.

Type On - Write On Transparencies

There is available a transparency which can be written on with a biro or typed on. It works in a similar way to a spirit stencil. It is also possible to purchase a special ribbon for a typewriter which will type on normal acetate. Generally for type on transparencies it is recommended that no more than seven or eight lines are used, and that a primary typewriter be used to ensure that the image is large enough to be read easily.

ADVANTAGES AND DISADVANTAGES

ADVANTAGES

The Projector is Positioned in Front of the Class

This means that teachers can maintain "eye contact" with their students, and so are able

to gauge their response and adjust their presentations accordingly.

Bright Image in Fully Illuminated Room

A big advantage, because the teacher is able to maintain contact with the class during the presentation. There is no need to darken the room which could lead to inattention, drowsiness and disciplinary problems. At the same time the students' attention can readily be transferred from screen to teacher and vice versa.

Teacher Controls Presentation

By using masking the teacher can reveal the transparency at the best rate for the class needs. He or she can spend more time on difficult concepts if he or she feels the need and can go more quickly through the easier parts.

It Is the Most Versatile Projection Medium

The OHP will project transparencies or opaque materials, animated devices and fluids as well as the normal transparencies.

Teacher Can Create Own Transparencies

If there are no commercially prepared materials suitable, teachers can make their own, to suit their own individual needs. Transparency making equipment is relatively simple and inexpensive.

OHP Eliminates Repetitive Chalkboard Work

Transparencies can be kept and be readily available for use next lesson, next week, next year. This makes more class time available for instruction and review.

Complex Subjects Can be Presented in Comprehensible Units

By using overlays and/or masking it is possible to build up a concept step by step, or to break down a whole into component parts. Students can be gradually led into a subject rather than being suddenly drowned in a sea of knowledge.

Colour Can Be Used Effectively and Economically

Colour can be added using pens, colour adhesive film or coloured heat sensitive acetate. Especially useful for emphasising parts of graphs, maps, charts etc.

Projection Requires a Minimum of Skill

There are very few controls on an OHP and these are very simple to operate - students can use the projector to present their work to the class.

DISADVANTAGES

Transparencies are Needed

Clearly, you will have to prepare transparencies in advance if you are going to use the OHP.

Class Cannot Keep Up with the Teacher

The greatest danger is for the teacher to work too quickly, not giving sufficient time for students to read material on the OHP. Rather than expecting them to copy the material, printed copies of the OHP should be handed out in advance.

4. TEACHING BY TELEPHONE

The telephone is the most widely available instrument of modern communication technology. Almost all of us, teachers and students, are familiar with its use unhindered by any barriers associated with the mystique of the secrets of its operation. No special jargon is needed when talking about the telephone, no special expertise is needed to make it work. Furthermore, the telephone in Australia almost always does work: we pick it up with confidence that it will behave as we expect.

All this means that the teacher who decides to use the telephone can be confident with the basic equipment and be sure that students share this confidence.

The effectiveness of the modern telephone has revolutionised external studies. It has made possible easy and direct communication between teacher and student and broken the old and sterile perception of external teaching as merely a form of impersonal paper shuffling. This has been achieved by the simple technique of the teacher ringing the student or the student ringing the teacher. Effective as this simple one-to-one use of the telephone is in external studies, it has turned out to be merely the forerunner of a range of uses of the telephone which have the potential to change all forms of teaching, not only external studies.

In addition to its familiar use as the means for allowing conversations to take place between people in different places, the telephone's potential for other uses has been greatly expanded by the availability of equipment which either enhances its basic function or supplements that function.

Equipment which **enhances** the basic function of the telephone includes:

- loud speaking telephones;
- loud speaking telephones with multiple microphones;
- teleconference bridges.

Equipment which **supplements** the basic function of the telephone includes:

- facsimile or fax;
- interactive computers;
- video.

Through the use of some or all of this equipment it is possible to use the telephone for a wide range of different teaching purposes:

- individual tuition;
- group tutorials or seminars;
- lecture;
- guest lecturer;
- tandem teaching;
- counselling;
- guest expert;
- linking classes;
- panel discussion;
- brainstorming / buzz group
- case study interview.

However some of these are more likely to be successful than others and all of them have their pitfalls as we shall see.

Let's start with a closer look at the equipment.

THE EQUIPMENT - DESCRIPTION

TELEPHONE

This basic piece of equipment is no doubt very familiar to you.

Loud Speaking Telephone

This is simply a telephone which incorporates a loudspeaker so that several people can listen to what is coming down the line. It can also be used as a standard telephone by switching the loudspeaker off and using the earpiece.

Loud Speaking Telephones with Multiple Microphones

This adds to the loudspeaking telephone a set of microphones so that several people can not only listen in but also take part in any conversation without the inconvenience of passing around a single mouthpiece.

In South Australia a well tried and tested piece of equipment for doing this job is known as the DUCT system (DUCT - Diverse Uses of Communication Technology). For convenience sake we will use the expression DUCT from now on but his should not be taken to mean that only that specific item of equipment could be used for the purpose described.

Teleconference Bridge

This is a device which allows the linking together of multiple telephones into one call. Telecom provides a bridge service which can accommodate up to 10 separate lines in the one hook up. On-site bridges are also available which enable you to link up to five incoming calls in the one hook-up without Telecom assistance.

FAX (FACSIMILE)

This device has also become very familiar to us all in recent times. It uses the Telecom network to transmit hard copies of documents and can be used in tandem with the telephone provided that separate lines are available and that the people at either end of the line have fax machines. If only one line is available the fax can be used to transmit documents before or after the conversation.

TTY (TELETYPEWRITER)

This is an invaluable device for communication between deaf people or between hearing people and deaf people. It is connected to a telephone using acoustic phone cups so that the user can send and receive messages in typed form. Typically the TTY includes both a liquid crystal display on which the message can be read as it is received and a printer which uses a paper roll similar to that which is used in a cash register. It does not produce a full size print-out like a fax machine but it does give a hard copy on which data

you wish to save is recorded. The chief purpose of the TTY is the same as that of the telephone - conversation. Although it uses print it should not be thought of as a conventional print medium.

The TTY is portable and may be connected to almost any traditional telephone handpiece. One TTY can be used by several teachers who may have deaf students.

The TTY is used for one-to-one conversations. It would be very unwieldy in a teleconference.

INTERACTIVE COMPUTERS

Computers can be linked together via the Telecom network and, with the appropriate software, this linkage can be done in such a way that parties at either end of the line can work on the same material at the same time. This also requires separate lines for the computer and telephone links. Although such links are currently in use in some places it has to be said that the software is still in a developmental stage and that there is some complexity in its operation.

VIDEO

Equipment to provide a video link between users of the Telecom network is now commercially available. This enables speakers to see one another and to show things or processes to one another. At least one of the products available also incorporates facilities for a computer link.

LEARNING CENTRE

In a number of education systems in Australia and around the world **learning centres** have been established. Basically these are places where students have access to educational opportunities which would not otherwise be available in their local community. For example the community may be too small to allow the formation of viable classes in most courses, or there may be highly specialised courses which are normally only available in one college in the chief metropolitan centre of the state or region.

One of the ways in which a learning centre can provide this access is through telephone links to other centres where these courses are available. This may be through an extensive network of campuses or through only one or a few links to other places. This will depend entirely on the circumstances of the system in which you work.

Ideally a learning centre will make available a range of services which it is unlikely that the student would have at home.

In the case of telephone teaching these would include multiple telephone lines so that telephone teaching there can take advantage of the supplementary equipment such as fax (just about a basic item these days), video, loud speaking phones, computer (possibly interactive) and so on.

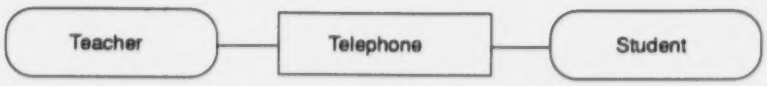
Usually the learning centre is staffed, often only part time, by someone who can offer support services to the students who make use of it. This person is not expected to be an expert in all possible teaching areas but an educator who understands the needs of

students and who provides a link to the education system, or systems, with which the study centre is linked.

USING THE EQUIPMENT - TEACHING NETWORKS

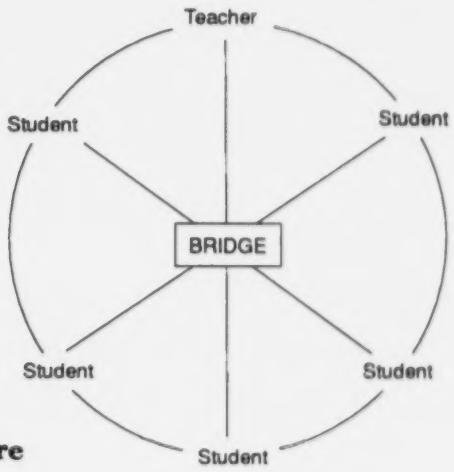
This equipment can be used to set up a number of different kinds of teaching networks.

Individual Tutoring/Counselling



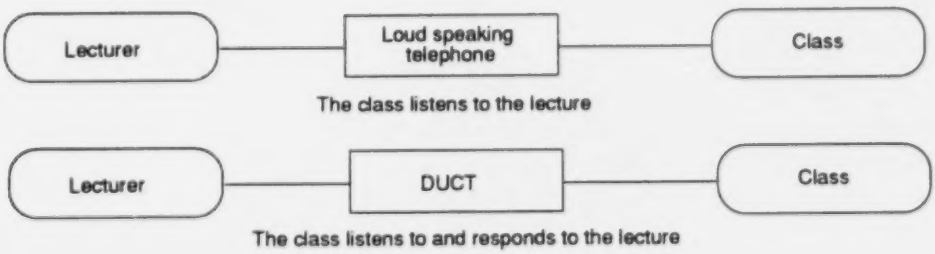
Group Tutoring/Counselling/Brainstorming/Buzz Session

Teacher need not be included in brainstorming or buzz session

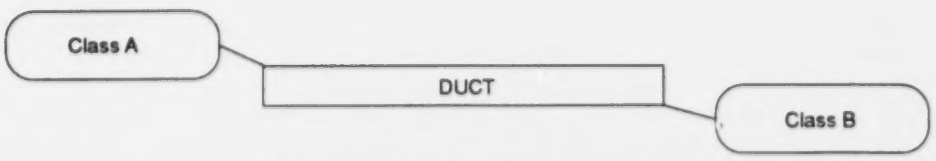


Everyone can hear everyone else

Lecture/Guest Lecture

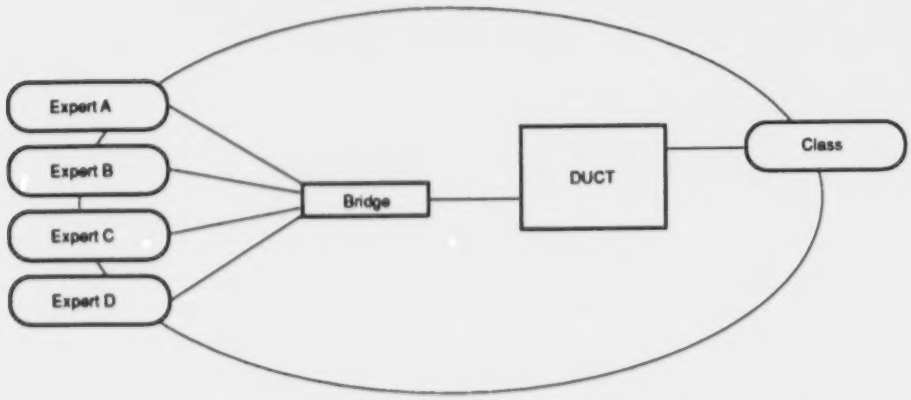


Linked Classes



All the people in each class can hear one another

Panel Discussion/Guest Expert (i.e. one expert only, no panel)



The experts can all hear one another and the class. The class can hear all the experts.

These basic networks can be varied to suit the occasion and all of them could be used in conjunction with interactive computers, fax or video.

Using the Equipment: Some Considerations

Although there are diverse ways in which it is possible to use the telephone, as with any technology or teaching technique you need to decide when and how it is appropriate.

The greatest strength of the telephone as an aid to teaching is that it allows **two way communication** between the people at either end of the line. In terms of cost it is generally cheaper to telephone someone at a distant location than to go there to talk to them.

If you are thinking of using the telephone in your teaching you should ask yourself if it is in fact the best possible medium for your purposes. **If no two way communication is required then there may well be more effective alternatives.**

The most obvious example of this is the lecture. Why not use audio or video tape or even radio? All of these can be used so that the same lecture, delivered only once, reaches a great number of people. These media are even more effective than the classroom lecture if no dialogue is to be entered into between lecturer and student. They all reach more people at once, and tapes can be used at leisure, replayed, paused and so on.

SOME TELEPHONE TECHNIQUES

Even one-to-one conversations on the phone can be made more effective through the application of some simple techniques. More complex activities like teleconferences can be disasters without them.

Establishing a Teleconference Using Telecom Bridge

The first step is to arrange with the students the time at which you intend to hold the teleconference. You will also need to get from them the number of the telephone which

they will be using. As Telecom establishes the teleconference by ringing each of the participants **in advance** of the starting time you also need to ask students to be ready by their telephones at least 5 minutes ahead of the starting time for the teleconference.

Next you ring Telecom's Conference Call number which is listed on the *Operator Services and Charges* page of your telephone directory.

The operator will want to know your name and number, the names and numbers of the people you wish to be linked to, the number(s) you wish the call to be charged to (the cost may be shared around all participants), the time of the call and whether or not you want the cost to be phoned through to you at the end of the teleconference.

Up to 10 sites can be linked via a Telecom bridge.

In Case of a Poor Connection

Occasionally it can happen that you have a poor connection which makes effective communication impossible. If the teleconference link has been established by Telecom the only thing which you can do is to have **all** participants hang up then ring Telecom, explain the nature of the problem and ask them to re-establish the conference call. Unfortunately you will need to use this method even if only one of the lines in the conference is unsatisfactory.

If you are using your own bridge only the affected line will need to hang up and reconnect.

However, as you will know from your own experience with using the telephone, bad lines are not a particularly common occurrence in Australia these days.

Establishing a Teleconference Using Your Own Bridge

This is much simpler. The students simply call you on the number to which your bridge is connected. If you wish to have your institution pay for the cost of these calls then you should arrange for the bridge to be used on a 008 line.

Information in Advance

The effectiveness of any telephone teaching is greatly enhanced if information which can be read, listened to or viewed has been distributed in advance.

For example, if you have to counsel a prospective student via a telephone call, send out any available prospectuses, syllabuses and so on before you get into any in-depth counselling. The more the student knows the more useful questions they will be able to ask you and the more what you have to say will mean to them.

For a tutorial session students will probably need to be sent transcripts or tapes of lectures, or simply reading lists. In electrical engineering there may be circuit diagrams that are needed, in accounting, balance sheets and so on.

Remember that time on the telephone costs money that can be saved with proper preparation. Whatever you teach you should know what the students need in advance.

Questions in Advance

As well as sending the students information in advance it is also a good idea to send them questions or some other kind of problem solving activity in advance of the telephone session. The purpose of this is not so that you can hear their answers down the telephone line, but so that they have been led to think in advance about whatever it is they are going to talk about during the telephone session.

If all you want is their answers then you don't need the telephone. Answers can be sent in by mail or fax. Just make sure that the students clearly understand the purpose of these questions. It is usually counter productive if they feel that the telephone tutorial session is some kind of oral test.

Making Up For Absence of Vision

Because you can't see the people you are talking to on the telephone (unless you are using a video link), you will inevitably come up against two problems:

1. In a teleconference **you will have trouble knowing who is speaking** - the students will have the same problem.

   There are two simple ways to get around this problem:

   Firstly, all participants should have a list of who is taking part. This is one of those pieces of information which need to go out in advance.

   Secondly, have all participants identify themselves as they start to speak. . . "It's Mary here, I'd like to ask. . . ", "Fred speaking, isn't it true that . . ."

   People don't do this naturally. You'll have to remind them at first, but they'll soon get into the habit.

   If you have a small group or a group that has regular and frequent teleconferences then this might become unnecessary as people get to know one another's voices. You will have to be the judge of that.

2. **Silence is very hard to interpret**. In face to face conversations or in the classroom the reason for a silence is usually obvious from people's behaviour, their body language or simply the expression on their faces. On the telephone you don't even know if they're still there, let alone what they are doing.

   One result of this is that silences seem to last an unbearably long time. If a question has been asked it is most likely that the answer requires some thought. The silence is almost certainly a pause for reflection. But once again you cannot tell when the pause for reflection has become the silence which results from an inability to come up with an answer.

   This will lead you to the problem of deciding when to intervene to keep things rolling along. There are no simple rules for this - you must be aware that this is a problem and learn to play it by ear depending on your knowledge of the students and the subject.

It is also quite likely that this problem of interpreting the silence will lead you to an associated problem with the student who is always quick off the mark, always has something to say and may be impatient of the relative slowness of other students. This is a problem which you will be familiar with in the classroom and to some extent you will need to deal with it in similar ways on the telephone.

Making Sure That Everyone is Involved

In the classroom the quiet student can often be ignored or overlooked, left to play the role of the passive onlooker. This is even more likely to happen in a teleconference.

Having each person identify themself when they speak is the first step in getting around this problem.

The second is having your list of participants.

It is relatively easy to keep track of the involvement of students in a telephone session. A very simple system involves simply ticking by a students name when they have something to say:

Elsa ✓✓
Ivan ✓
Lily ✓✓✓✓
Jack ✓
Nguyen ✓✓✓✓✓✓✓
Margit ✓

A pattern like this would tell you that you need to do something to even up the participation but doesn't tell you much about what is going on.

A not much more difficult system tells you more. In this system ✓ tells you that the student has answered a question in some substantial and relevant way, ? tells you that they have asked a question # tells you that they have said something that is a positive contribution to the discussion without it actually being a question or an answer while O tells you that they have said something that is not a substantial contribution like "I don't know" or "What did you say?" or "Excuse me someone's at the door".

This helps you to form a clearer picture of what is going on:

Elsa ✓✓
Ivan O
Lily OO?✓
Jack ✓
Nguyen O✓#?O✓O
Margit ✓

Even with this you still need to keep your wits about you to enable all students to play a fair share in what is going on while still keeping things moving.

Before you get to this stage it will help everyone to feel more at ease if you start off with a bit of stage managed "small talk", especially if this is a first session.

For example you can go around the group several times with a series of everyday questions such as:

- Where are you (Geographically)? What's the weather like there today?
- Where are you (At home, in a phone box, at the local TAFE college)? Are conditions comfortable for you to undertake this next hour (two, three) of teleconference?
- What's the latest news/gossip that's making life interesting where you come from?

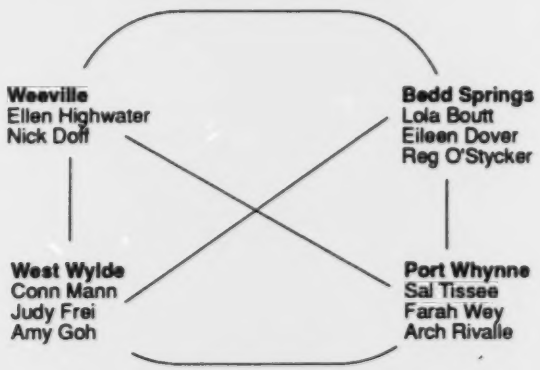
This gives everyone a chance to have something to say, to hear the voices of the other participants and to get used to introducing themselves when they speak. If you are running a series of such sessions you will probably find that it helps to begin each session this way. This takes the place of the opportunity which students in the classroom have to socialise with each other, and you, before the session gets formally under way.

If Your Teleconference Includes Several Groups

It may be that your teleconference will include several groups who are using a loud speaking telephone with multiple microphones. In this case you need to keep your list of participants in groups:

Weeville	Ellen Highwater Nick Doff
Bedd Springs	Lola Boutt Eileen Dover Reg O'Stycker
West Wylde	Con Mann Judy Frei Amy Goh
Port Whynne	Sal Tissee Farah Wey Arch Rivalle

A possible problem with this is that you pay more attention to those at the top of the list or that you feel a closer rapport with some groups than others. To some extent you can get around this by using a circular layout like this.



This helps you to think of your teleconference class as a network - not as a distribution of people in which some are "here" and others "there". This "here" and "there" difficulty is particularly likely to arise if one of the groups involved is actually with you in person.

All of this might seem like a bit much but in practice it very quickly becomes second nature to you. At first there are things which you have to be reminding yourself to do but before long you simply do them as a matter of course.

PUTTING IT ALL TOGETHER - THE TELEPHONE AND TEACHING

Finally we need to look at some of the practical applications that all this might have in your teaching whether you teach mainly by external studies or in the classroom.

We begin with a reminder that the telephone is best used when you need **two way communication** for at least part of the session which you are planning.

Individual Tuition

Quite possibly you have already used the telephone to help out a student with queries or problems with a course that you teach. Most likely the student 'phoned you - clear evidence that telephone technology is seen as "friendly". This kind of use of the telephone is so widespread that it hardly needs any explanation here.

Group Tutorials or Seminars

The telephone is an ideal medium for helping students who are isolated from one another, and from you to get together. They may be isolated by virtue of distance, disability or personal circumstances such as shift work which prevents them from attending on campus. Whatever the reason such students may be linked together by teleconference.

This may be done with the students in their own homes using their own phones. An alternative is for two or three students to come together on a number of different campuses where there are learning centres.

Lecture

There is not much point in using the telephone to deliver a lecture where the communication is all one way. You will know from experience how hard it is to maintain concentration in such a lecture when you are actually there in the lecture theatre or classroom. On the phone this is even worse.

However many effective lectures incorporate considerable scope for interaction between the lecturer and the class. Perhaps there is a place for this style of lecturing by telephone.

Even so the audience is limited. Remember a teleconference bridge can handle only a maximum of 10 lines. Possibly this could be used in conjunction with loud speaking telephones at each receiving station. Usually lectures are provided in a course because they are a means of getting the message across to a large number of people at the one time. The telephone has limited value in this respect.

Guest Lecturer

One justification for the use of the telephone to provide a lecture may be that it gives you the chance to use a guest lecturer. You may use a loud speaker to deliver this lecture to a large group of people.

If your guest lecturer is in Brisbane and your class is in Perth it is far cheaper to use the phone than to pay air fares and accommodation.

Even so a videotape or audiotape would be cheaper still if no dialogue were required between lecturer and class.

Tandem Teaching

As with the guest lecturer this allows you to access the expertise of someone who is physically distant. In this case you would be working in a classroom using something like the DUCT system to allow students to hear your distant partner and to interact as necessary.

Counselling

The telephone can be invaluable as a means to provide counselling to students or potential students who because of distance, disability or incompatible schedules cannot meet you in person. Remember in this case that the most effective counselling will occur when the student is well informed in advance. Send out any written information in advance.

Guest Expert

This is much like tandem teaching except that your guest may well not be a professional teacher but someone whose expertise in their professional field is invaluable to your class. In such a case you act as the facilitator to keep the session going along the desired channels. Perhaps you may ask some key questions, or perhaps they will come from your students. Once again this is an interactive situation where DUCT or similar equipment will maximise the opportunities for class involvement.

Panel Discussion

This is an expanded version of the guest expert. Several guests may take part in a discussion either among themselves with the students listening in, or with the students participating. Here the cost savings achieved by replacing travel and accommodation costs with telephone costs are multiplied.

Linking Classes

Another application of DUCT type equipment is to link two classes which are studying the same or very closely related courses. This can be especially valuable if the local environment for these two classes is significantly different. For example the Adelaide College of TAFE in South Australia linked a class in marketing with a similar class in the United States. There were many fruitful discussions about the application of basically the same principles of marketing in two different markets. Equally the potential to link classes in rural communities with classes in metropolitan communities offers similar opportunities for looking at the same problems from different angles. This may be done

just 'one off' or on a regular basis.

Brainstorming / Buzz Group

Telephones linked by conference call offers the opportunity for brainstorming or buzz groups with or without the use of DUCT type equipment. The links may be between students or simply between teachers doing some course planning or preparing assessments. The advantage of the conference call is that everyone can be involved at once. There is no need to rely on multiple contacts between pairs of people in which there is a dependence on the ideas and information from one conversation being accurately and fully reported at the next.

Case Study Interview

In courses which involve the need for case studies or similar discussion with people who have been involved in incidents or situations which may be of particular interest to your class you may be able to arrange for the class, using DUCT type equipment, to interview the individual concerned. For example there are many rural courses in which case studies of particular properties are used. Use of the telephone in one of these courses may enable a class, which has had the opportunity to read written material in advance to talk to farmers whose properties are in distant locations and to ask clarifying questions which arise from their reading.

In a different set of circumstances where the issues concerned may be particularly sensitive use of the telephone, without video, may help to preserve confidentiality, to enable an interview to take place without exposing the individual's identity.

5 COMMANDMENTS FOR USING THE TELEPHONE IN TEACHING

1. Use the telephone only for situations where interaction is required. Send bulk information by other media.

2. Make sure that all participants are thoroughly prepared in advance.

3. Use some deliberate technique to keep track of each participant's active involvement.

4. Don't struggle on with a bad connection. Make sure that the lines are clear and the message is not distorted.

5. Make sure that you and the other participants are ready and by the telephone in advance of the time set down for a teleconference to begin.

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5. FACSIMILE (FAX)

DESCRIPTION

Facsimile (or fax) is defined as the exact reproduction and transmission to another location of an original document, normally by ordinary telephone line. Normal office facsimile transmits and receives documents (usually A4 size) which may include text, diagrams, signatures and graphics. Because the information is transmitted over the public telephone network, world -wide communication is possible.

Compatibility between facsimile machines is essential for total communications. Several standards have evolved and are laid down by the Consultative Committee, International, for Telephony and Telegraphy (CCITT). Since early standards were written after facsimile machines were in common usage, many older facsimile machines are only able to communicate with others from the same manufacturer. Newer facsimile machines conform to CCITT standards and compatibility between equipment is no longer a problem. The standards for facsimile machines are known as Group I, Group II and Group III, with the Group IV standard currently being developed.

Group I machines, the first to conform to a standard, are slow and require six minutes to send a piece of A4 paper. The standard for Group I was set in 1968 and amended in 1972 and 1976.

Group II machines are faster, at three minutes per A4 sheet, and they conform to the standard set in 1976. Many Group II machines have the capability to "talk" to Group I machines. Group I and Group II machines have not been sold for some time and are basically redundant, except to the extent that quite a few existing users of the old machines still exist.

Group III machines conform to the latest CCITT standard established in November 1980. They have transmission speeds of less than one minute for an A4 page, and better image quality than the older machines. Standards are currently being developed for Group IV machines which will give faster transmission and higher quality again, but the Group IV standard was designed with digital telephone lines in mind.

THE BASIC FACSIMILE PROCESS

Sending and receiving a document by facsimile consists of six steps;

- scanning the original;
- recording the scanned image;
- modulation / demodulation;
- transmission;
- printing;
- synchronization.

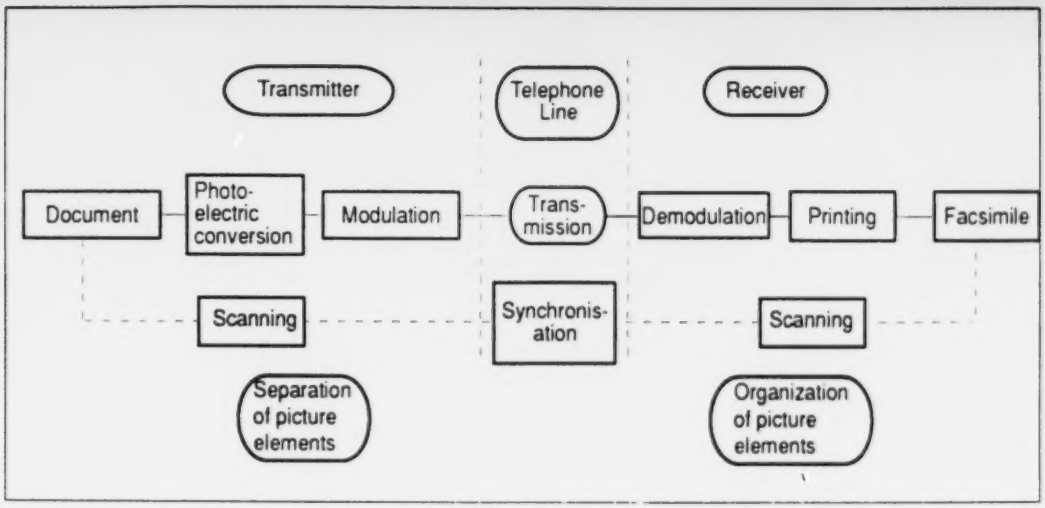


Figure 5.1 The basic facsimile process

Scanning

An image of the original document is formed by a lens in a way similar to that of an ordinary camera, except that a linear array of small photodiodes in the facsimile machine does what the film does in the camera. The portion of the image falling onto the linear-diode array is a thin line 0.13mm high across the top of the page being scanned. Typically, up to 2000 diodes are used to view this line for an image as wide as an A4 page.

The photodiode corresponding to the upper left position on the page is first checked to determine whether the very small portion of the image it detects is white (paper background) or black (image). Each of the diodes is checked in sequence to 'read' across the page before the original document is stepped a distance equal to the height of the thin line and then the next line is 'read'. This step-and-read process is repeated until the whole page has been scanned.

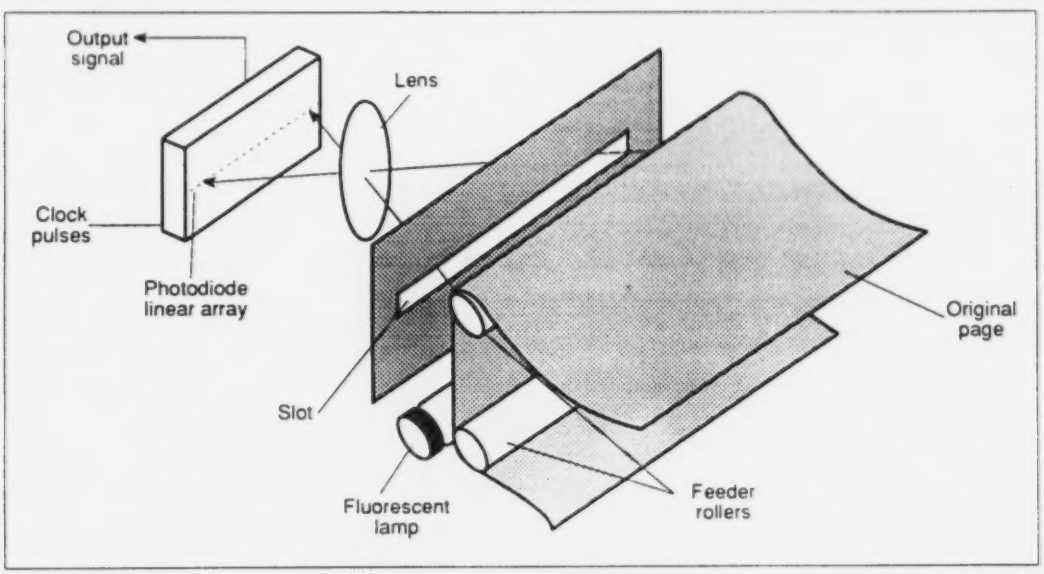


Figure 5.2 The scanning process

Recording

To transmit a document the facsimile machine has to convert the brightness of reflected light into electrical signals. Technological advances in this area have seen photodiodes, phototransistors, and linear-array sensors used to achieve this. The line image sensor reads one horizontal scanning line at a time, and it can handle picture element separation, photoelectric conversion and scanning.

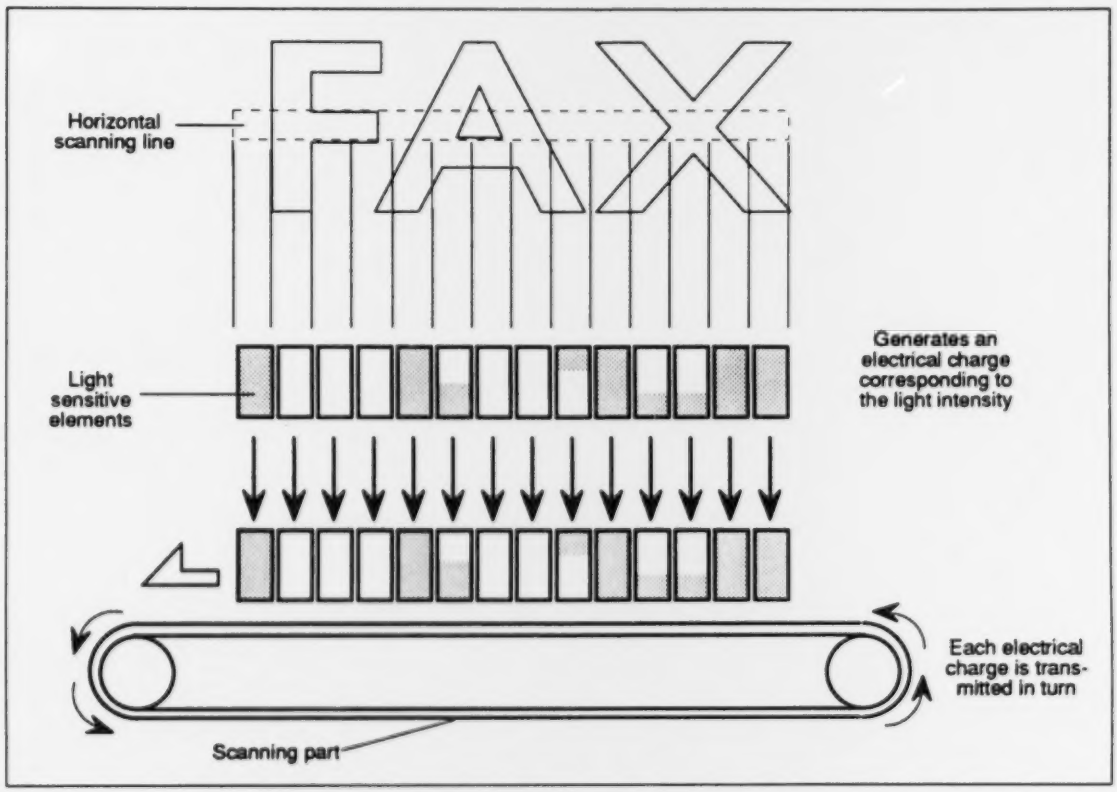

Horizontal scanning line
Light sensitive elements
Generates an electrical charge corresponding to the light intensity
Each electrical charge is transmitted in turn
Scanning part

Figure 5.3 The line image sensor

Modulation / Demodulation

Facsimile documents are encoded into a series of electrical pulses, with the sequence of pulses depending upon the image being transmitted.

Most of the existing telephone network is 'analogue' and cannot carry digital traffic. Thus, the digital codes generated by the facsimile machine have to be converted into analogue form (i.e. electrical currents which alter in strength according to the amount of black or white on the document) before being transmitted.

To enable them to do this, facsimile machines incorporate a built-in modem which converts digital signals into analogue at the sending end and from analogue back into digital at the receiving end.

The most important point about modems is how quickly they transmit data. Transmission speed is rated in 'bits per second' (bps) and the higher the 'bps rating' the faster the modem. Group III machines have 9,600 bps modems which are technically capable of transmitting an A4 page in 20 seconds, although overall speed is affected by other factors too, especially line quality.

It is not uncommon for facsimile machines to adjust speeds automatically depending upon the receiving speed of the other machine and the line quality.

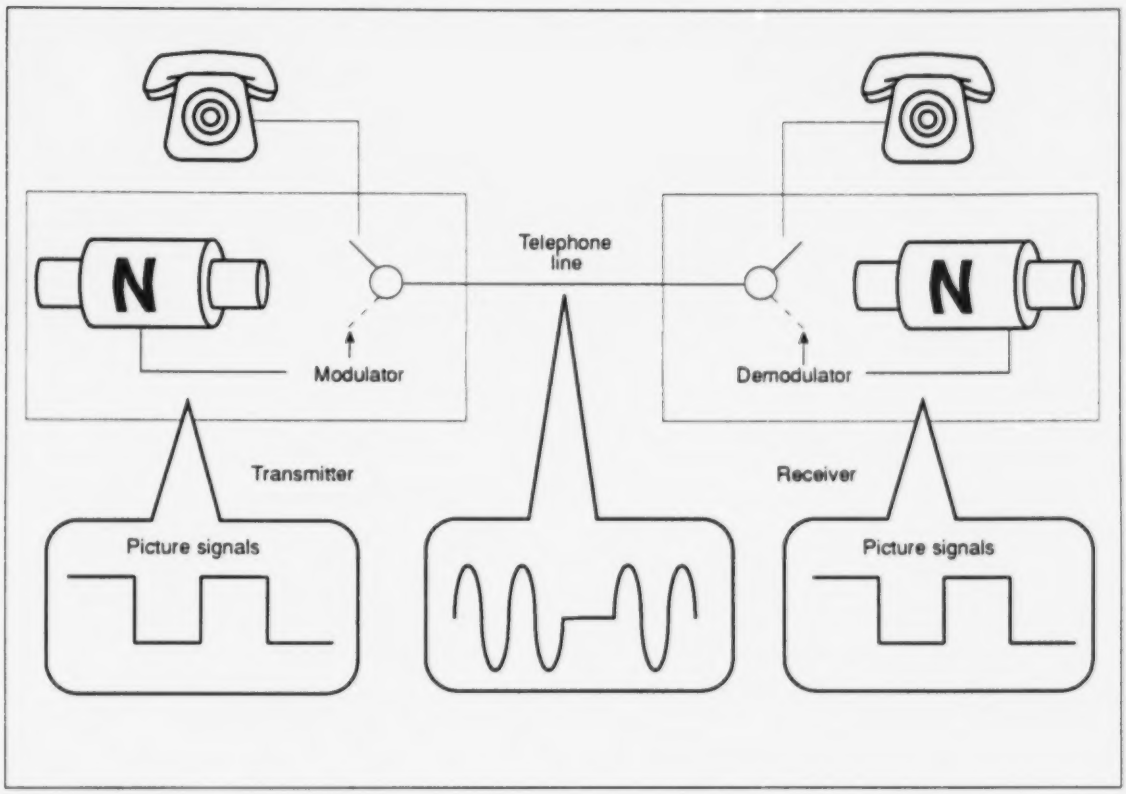


Figure 5.4 The modulation/demodulation process

Transmission

The modulation process also involves adding the signal containing the image to a high frequency carrier signal which can travel along the telephone line. At the other end the process is reversed as part of the demodulation process, and the image signal is unpacked to be sent to the printer.

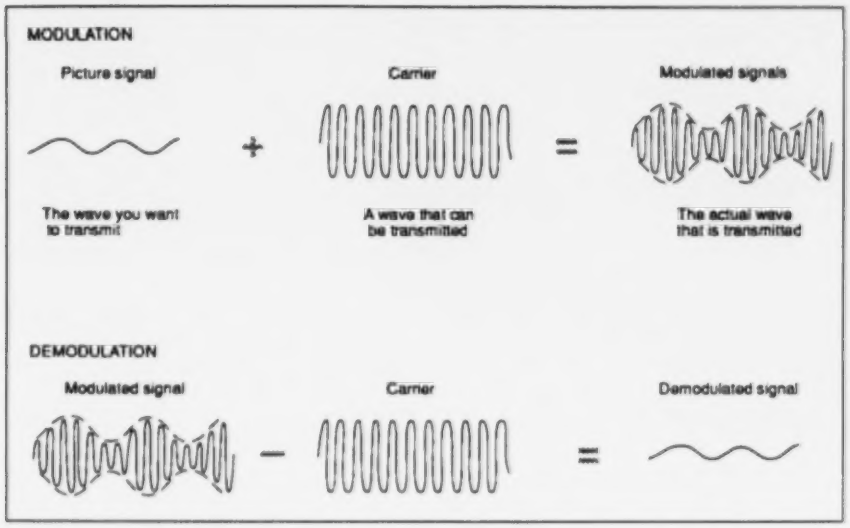


Figure 5.5 Putting the picture signal onto a carrier and taking if off again

Printing

The printing process converts the transmitted signal back to a visual representation of the original. We will briefly cover three different techniques which have commonly been used in facsimile machines, viz thermal, ink-jet and electrostatic printing, and laser printing.

Thermal printing requires a special thermal recording paper which is coated with a layer of heat sensitive material which changes colour when it is heated. As the recording paper passes over the print head images are printed onto the paper as it reacts to the heat generated by each heat element.

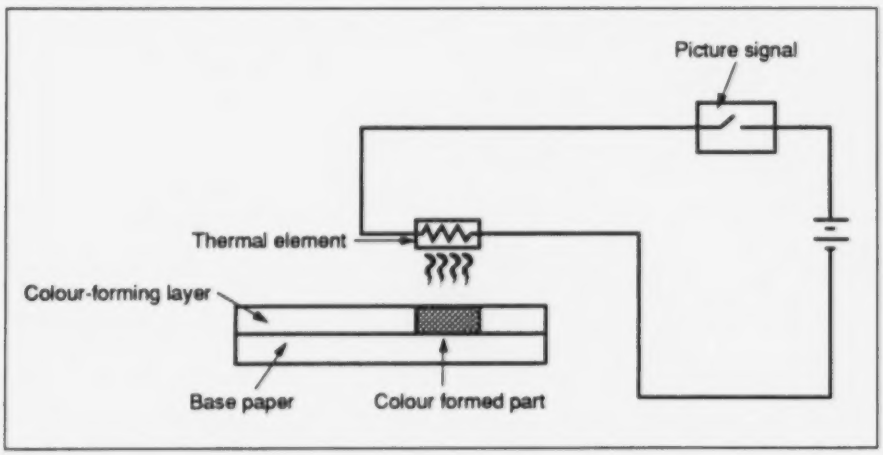


Figure 5.6 Thermal printing process

In the ink-jet printing process, a nozzle sprays a jet of ink particles onto the paper.

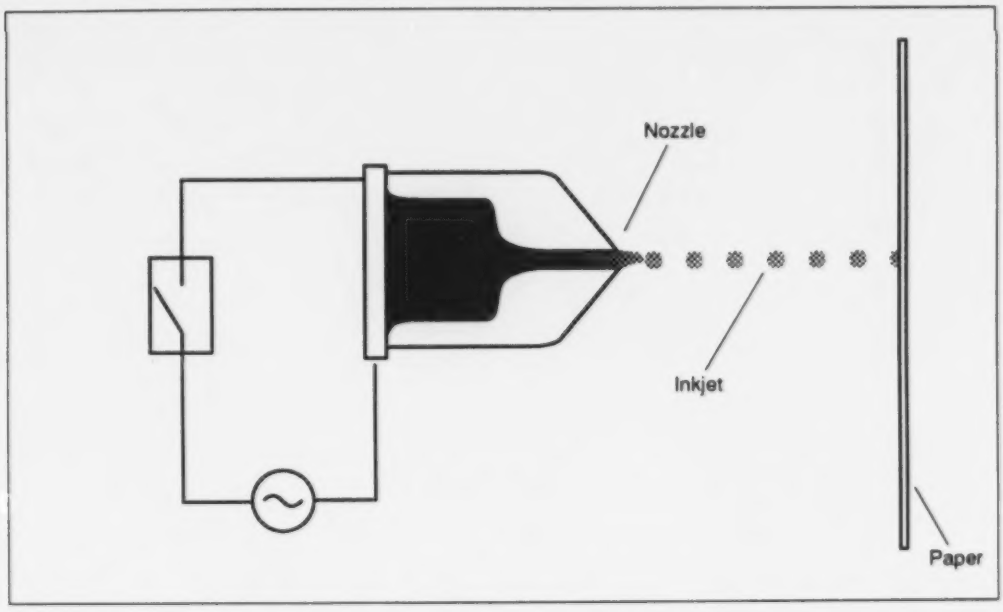


Figure 5.7 Ink-jet printing

Paper which has a low electrical resistance, and which has been coated with an insulating resin, is used in the electrostatic printing method. When a recording needle is charged with a voltage corresponding to the picture signals, an electric charge accumulates on the recording paper in a certain pattern. The toner (of the opposite polarity) sticks to the charged particles on the paper and is fused by heat, thus fixing the image.

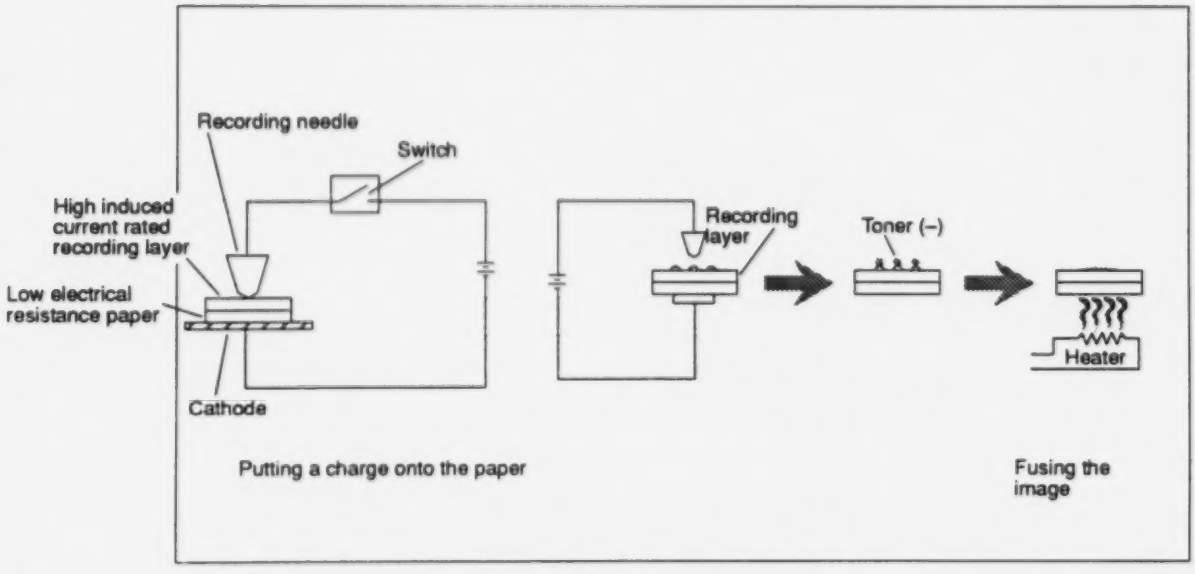


Figure 5.8 Electrostatic printing

SUMMARY OF OLDER PRINTING METHODS

Printing method	Advantages	Disadvantages
Thermal	• Simple construction • Almost maintenance free • Inexpensive paper • No noise, no odor	• Printed documents fade in time
Inkjet	• Can use plain paper • Color printing is possible • Print does not fade with time	• The nozzle must be checked regularly
Electrostatic	• Good contrast • Print does not fade with time	• Mechanism must be checked regularly • Easily affected by environmental changes • Complicated mechanism

The Laser Printer

A laser printer comprises two major internal parts; a video controller and a printer 'engine'. The video controller communicates with the facsimile machine and produces video signals from the print data which it has received. These are then input to the printer engine which changes them into signals which drive the laser beam as the first stage in producing the print images.

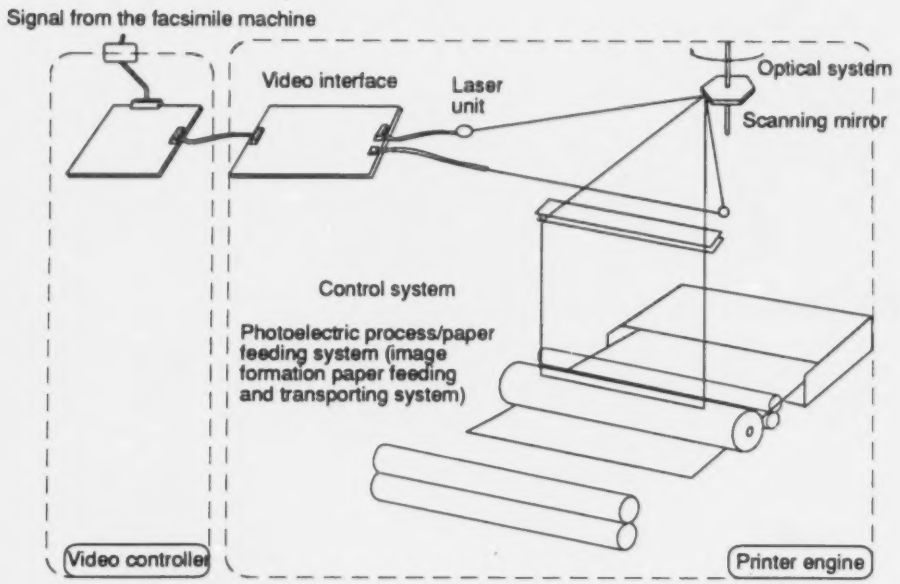


Figure 5.9 Components of a laser printer

Laser printers form images using the dot matrix method. Each dot in the matrix is called a pixel, and each pixel corresponds to a laser beam spot.

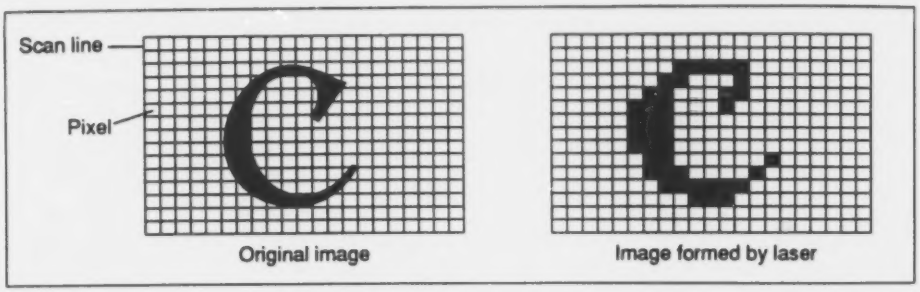


Figure 5.10 Pixels and laser beam spots

Because the laser beam spot has only a small diameter, it can only expose a fixed position, so a mirror is used to cause it to scan the image a line at a time. The scanning cycle is repeated until the final image is complete.

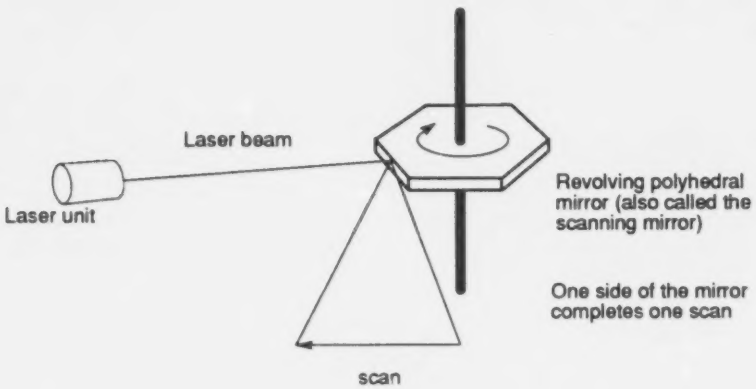

Laser beam
Laser unit
Revolving polyhedral mirror (also called the scanning mirror)
One side of the mirror completes one scan
scan

Figure 5.11 The mirror causes the laser to scan sideways

The video controller converts the images represented as pixels into electrical signals and then sends them to the printer engine which converts them into laser drive signals which turn the laser either on or off.

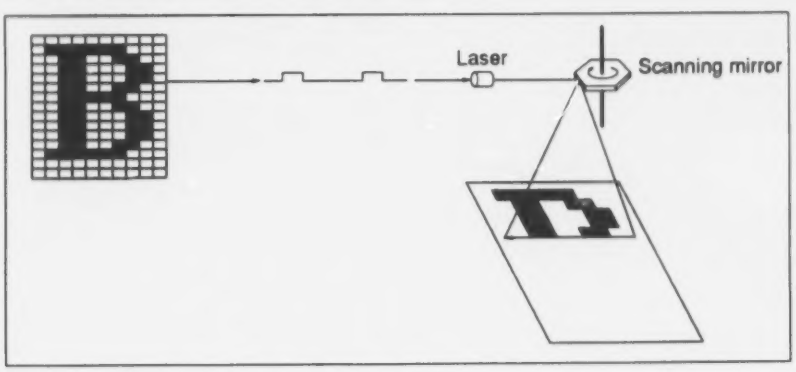


Figure 5.12 From video signal to laser drive signal

The laser beam does not write directly on to the paper. It scans a photosensitive drum which turns at a steady speed to allow the laser beam to form images derived from the video signals.

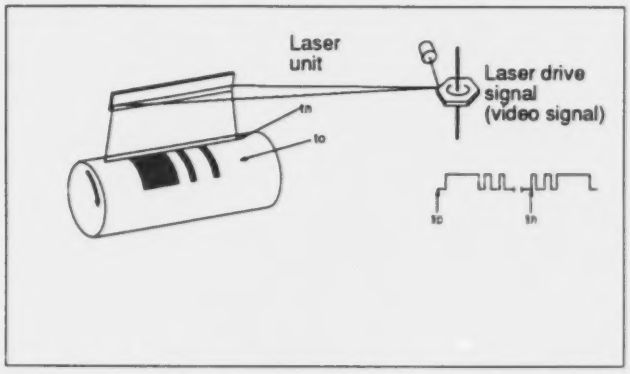


Figure 5.13 Forming a latent image on the photosensetive drum

The latent image on the drum is turned into a visual image which is transferred to paper in a five-stage photoelectric process.

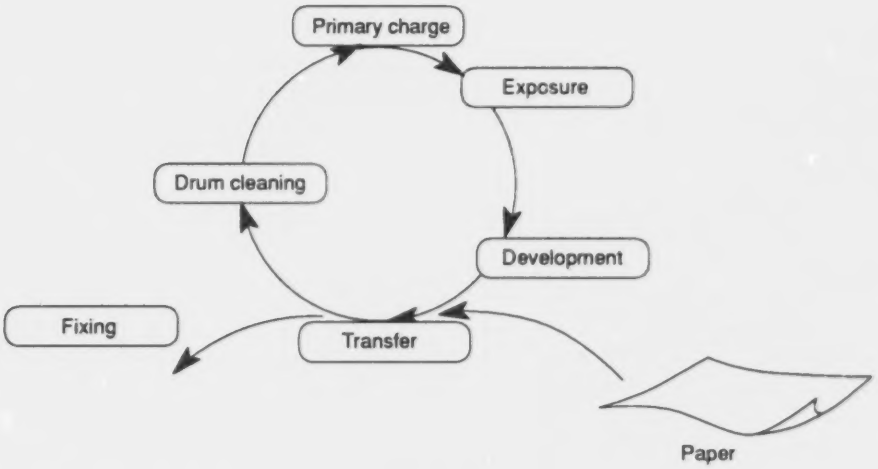


Figure 5.14 The photoelectric process

Synchronization

Some quite sophisticated electronic processes ensure that the sending machine and the receiving machine are synchronized and so are able to "talk" to each other. This is a significant advance from the method used by Scotsman Alexander Bain in 1842 when he was pioneering facsimile transmission. He used pendulums on each of the machines and he had to make a special arrangement to keep the receiving pendulum swinging in synchronization with the sending machine by restraining its movement if it got ahead.

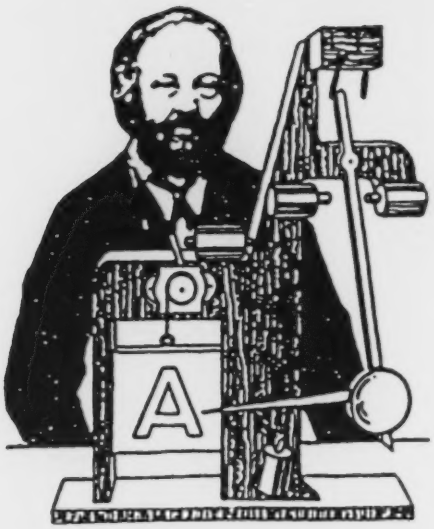


Figure 5.15 Bain's telegraph, circa 1842

GETTING MORE FROM YOUR FAX

AUTO DIALING

The addition of auto dialers to facsimile machines brought with it associated benefits which can be most useful in either a teaching or a business environment, including automatic re-try, delayed send and short code abbreviated dialing.

Automatic Retry

Automatic re-try means that when you dial a number which is busy, the auto-dialer will try it again twice at five minute intervals. If there's still no luck after the third attempt, the auto dialer gives up.

Delayed Send

Delayed send allows you to pre-set the time when you want to send a message, key in the number to which you want it sent, place the document in the machine's feed tray or its memory and leave the machine to do the rest. This enables you to make use of cheaper telephone rates which normally occur at night. It is also possible to key in a queue of several numbers and up to 64 different times and locations for transmission.

Short Code Abbreviated Dialing

Short code dialing employs a small memory to store your most commonly called numbers, allowing you to recall them at the touch of one or two keys, rather than having to key in the whole number. It is not uncommon for this facility to cope with 100 locations which can be dialed using two keys and 32 which can be called using a single key.

POLLING / REVERSE POLLING

Polling involves other people leaving documents in the feeders or the memories of their facsimile machines so that a remote user can dial in and have it transmitted to their machine. It is another way of making better use of off-peak rates, since although the transmission is effectively two way, it only counts as one call, and this is charged to the machine which initiates the operation rather than the one which actually sends the document.

Multiple polling allows you to poll up to one hundred different machines in one operation by queueing up a sequence of polled numbers resulting in you receiving documents from each station, one after the other. This would appear to have an application where a number of students had to respond to something you had sent them.

Reverse polling takes the process a step further in that it allows you, while receiving from a remote facsimile machine, to set a document to be transmitted to the same party during the same call.

FACSIMILE MEMORY

All facsimile machines have some form of memory. The most basic machines have a working memory which allows them to perform particular functions, or auto-dial memory for storing abbreviated dialing codes. Now it is increasingly common for machines to have a storage memory for data i.e. a memory which allows you to store whole documents comprising both text and graphics.

On a non-memory machine, documents are scanned, but the machine makes no attempt to 'memorise' their contents, meaning that once a document is transmitted, it is lost. With a memory machine, documents can be scanned into memory prior to transmission. Once held there, the same document can be used over and over again for different functions without having to re-feed it through each time you want to send it to a new location.

It's very handy to have a memory where incoming messages can be stored automatically if the paper runs out in the machine, for example. This can save a lot of frustration if a sudden influx of messages results in paper running out while the machine is unattended.

Memory and Confidentiallity

Certain areas of the memory can be designated as private mailboxes. This allows you to send sensitive material directly into a recipients mailbox, where it remains until they key in a special security code or use a special access card to remove it.

BROADCASTING

Broadcasting (sometimes referred to as 'store and forward') is the most common use of facsimile memory. It allows you to transmit the same document, of up to eighty pages, to one hundred locations, sequentially.

This is taken a step further with 'relay broadcasting' or 'transfer broadcasting' which enables you to send a document to a remote machine, which is then instructed to broadcast that document to a further group of machines.

INTERFACING FACSIMILE WITH COMPUTERS

Interfaces are available which provide terminal-to-facsimile links, allowing terminals or computers to communicate directly with facsimile machines.

The normal, historical process, has involved using a terminal, microcomputer or word processor to create documents which are then printed before being distributed by facsimile machine as required. The terminal-to-facsimile links give you the capability of creating a document and distributing it in a single process.

The document, which may contain both text and images, is typed, scanned or retrieved from disk, and then sent directly to the memory of an appropriately equipped facsimile machine or personal computer. From your keyboard you then can instruct the facsimile machine to perform a variety of tasks, including:

- send the document to a private mailbox if confidentiality is important;
- send the document to a distribution list stored in the facsimile machine;
- make a local copy.

These commands can be combined as well. It is possible, for example, to instruct the facsimile machine to print a local copy and distribute to a list.

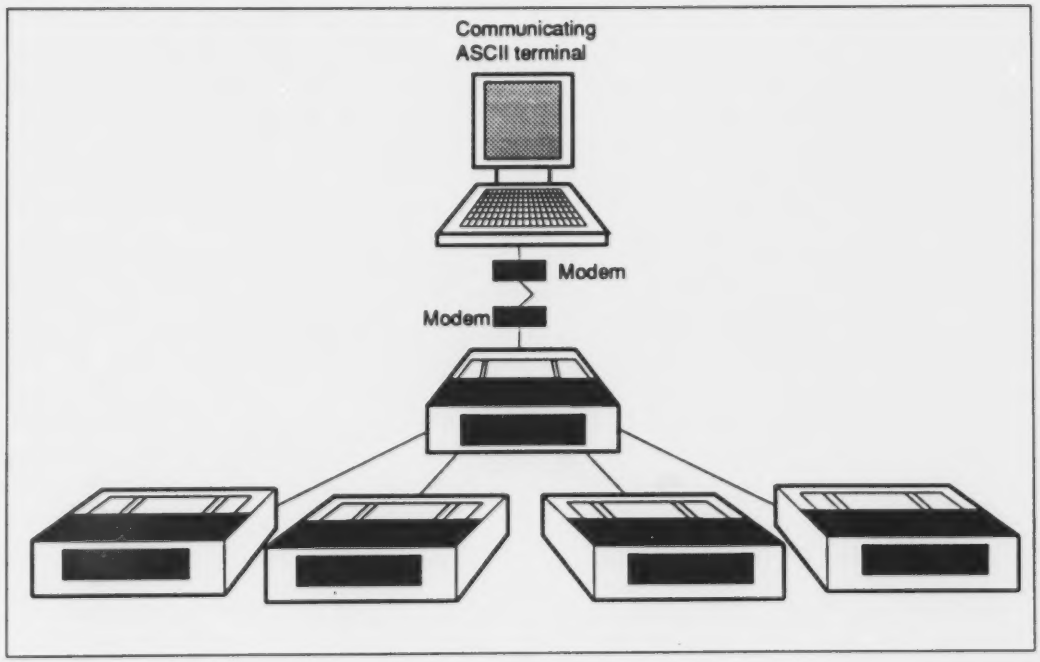


Figure 5.16 Interfacing computers and facsimiles

TEACHING WITH FACSIMILE

It has become increasingly necessary to install facsimile machines in educational institutions, both for administrative purposes and to improve educational opportunities.

During 1990 the Education Department of South Australia installed a facsimile network linking all 700 of the primary and secondary schools in the state. One major advantage of the network is the ability it provides to allow the central office to send information to all of the schools in the state within two hours. Schools are also able to respond to issues in a similar time span.

The system involves five machines at the central office feeding data to other machines in the five area education offices which then broadcast to "hub" centres which in turn broadcast to between four and twenty one schools.

Of course, the network is a valuable teaching tool also, in that it enables the provision of written support to voice lessons and immediate feedback on correspondence assignments.

DESIGNING MATERIAL FOR FACSIMILE

Practically any combination of text and image can be transmitted by facsimile, but if you are designing material specifically for transmission by facsimile there are some simple rules of thumb which you can use to achieve better results. The more detailed an original is the longer it will take to transmit, and the greater is the possiblity that the image received will not be an accurate reproduction of the original.

These simple guidelines should help you to prepare material which will be received clearly at the other end.

- avoid grey tones;
- avoid dense dark tones;
- avoid vertical lines;
- keep the original simple;
- use a vertical (portrait) format rather than horizontal (landscape).

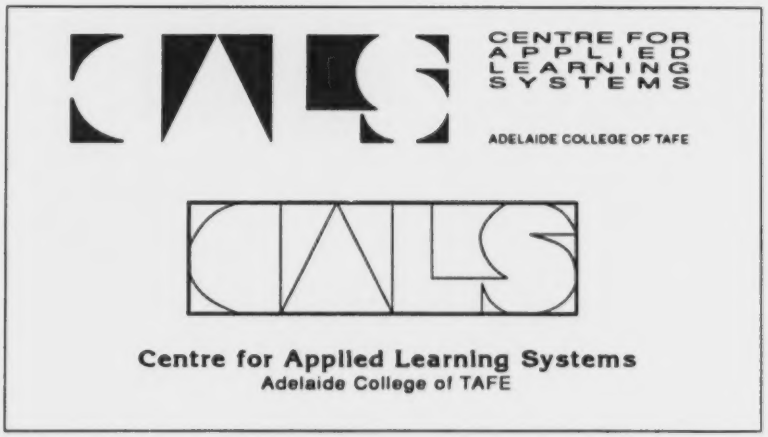


Figure 5.17 The simplified version of the letterhead will be better for facsimile transmission

6. AUDIO TAPE RECORDING

DESCRIPTION

Audio tape consists of a flexible base material such as mylar which is coated with a material which can be magnetised. The most common coating material is an iron compound called iron oxide.

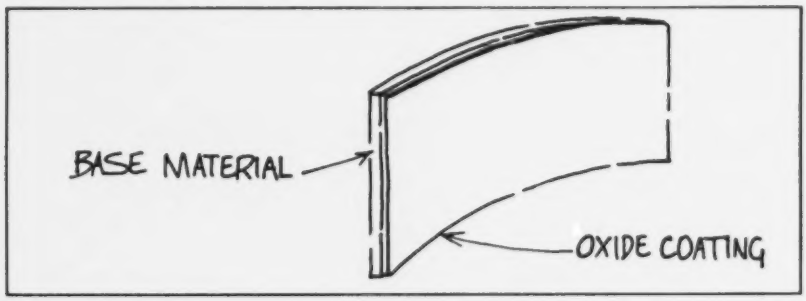


Figure 6.1 Structure of audio tape

If you look at a piece of audio tape you will notice that it has two different surfaces. The shiny surface is the mylar carrier and the duller surface is the iron oxide coating.

On a tape recorder the tape is fed from the left-hand reel and it has to be threaded by a particular path to reach the take-up reel. To distinguish this type of machine from the cassette recorder it is called an open reel (or sometimes reel-to-reel) recorder. Although these machines have largely been superseded by cassette recorders for most purposes, they are still used where a better quality recording is required than can be obtained from a cassette machine or where ease of editing is more important than simplified loading.

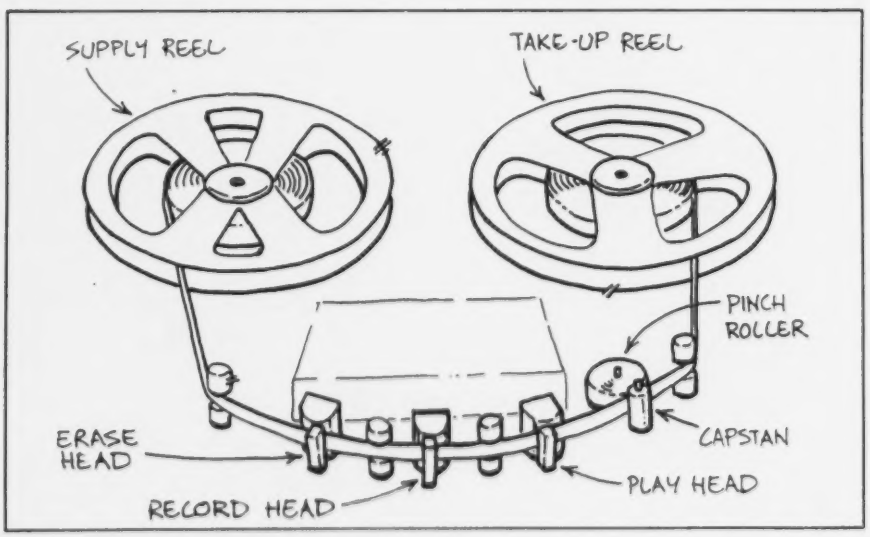


Figure 6.2 Layout of an open reel tape recorder

As the tape leaves the reel it passes the erase head, the record head and the play head in that order. Each of these 'heads' is a small electromagnet. The circular iron core is surrounded by a wire coil. When an electric current is passed through this coil the iron takes on the properties of a magnet. A north pole is formed on one side of the gap in the core and a south pole on the other. Bridging the gap is a magnetic field. The shape of the field is such that it bulges out of the gap.

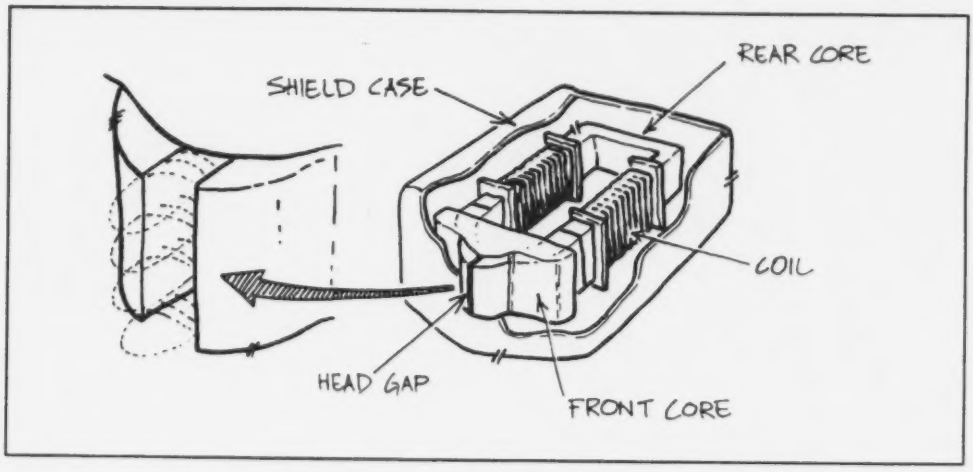


Figure 6.3 A mono tape head. Each tape recorder head is a small electromagnet

The strength of the magnetic field produced is proportional to the current in the coil. If the current is switched off, the magnetic field disappears and the iron ring no longer acts like a magnet. If the current through the coil is reversed the field produced is reversed; what was a north pole becomes a south pole and vice versa.

Let's now consider the action of the record head.

If you are making a voice recording the microphone converts the sound wave into an electric current of the same shape. This is then amplified and fed to the record head. As the coated tape is passed over the gap in the record head it encounters a magnetic field which is varying the same way as the sound wave varied. The coating on the tape is magnetised by whatever the field happens to be as the tape leaves the head. A varying pattern of magnetisation is thus formed all along the tape and it has the same shape as the original sound wave. This magnetisation is permanent and it will remain until the tape encounters another magnetic field strong enough to change its magnetisation.

An interesting and very useful property of the electromagnet is that its action is reversible. If, instead of passing a current through its coil winding, we somehow cause a varying magnetic field in the neighbourhood of the gap in the core, we find that an electric current is generated or 'induced' in the coil.

Let's consider how this relates to the action of the play head.

The magnetised tape passing over the gap in the play head induces a current in the play head coil which is the same shape as the pattern of magnetisation on the tape. That in turn is the same shape as the original current from the microphone. So if the output of the play head is amplified and fed to a loudspeaker we are able to hear the original sound again.

On a tape recorder with separate record and playback heads it is possible to record and playback the tape as it passes both heads so we have a very quick check on the quality of our recording. The tape retains its magnetisation indefinitely, so we can replay the tape recording on any machine whenever we wish.

Now we will consider the action of the erase head, which is the first head encountered by the tape.

When recording, a high frequency current of about 80 kHz is fed to this head. This has the effect of vigorously shaking up the magnetisation on the tape, if there is any from a previous recording, and leaving the tape demagnetised and ready to receive a new recording. One of the powerful advantages of the tape as a recording medium is that it can be erased and used again for different recordings. On the other hand, it is vulnerable to accidental erasure from any magnetic field which is sufficiently powerful.

TAPE SPEED

After leaving the play head the tape passes between the capstan and the pinch roller. The capstan rotates at a constant speed. The tape is pressed against the capstan by the spring loaded pinch roller and thus the capstan controls the speed of the tape both during recording and playback. The take-up spool is also driven, but only with sufficient power to take up the slack in the tape. It does not affect the speed.

Accurate control of tape speed is very important. If the tape travels faster on play than it did on record the pitch of the sound will be raised. Conversely, if it is replayed slower than it was recorded, the pitch will be lowered. If the speed varies slowly as the tape is played the resulting wavering pitch is called 'wow'. Some inferior machines have a tape speed which wobbles up and down at a fast rate, causing a distortion known as 'flutter'. It can be detected very easily on a recording of piano music, for example. The specifications for good quality tape recorders always quote a figure for 'wow' and 'flutter'.

The highest frequency which can be recorded is related to the width of the gap in the record head and to the tape speed. The smaller the gap the higher frequency, but this is fixed for us by the manufacturer of the tape recorder. The higher the tape speed the wider the range of frequencies which can be recorded and hence the quality of the recording. Many open reel machines give a choice of tape speed so that the user can decide whether quality or duration is important. A tape must always be played at the same speed as that used for recording and the reel itself should be labelled with this information so that the user is not in any doubt as to how to set the playing machine.

Early tape recorders used a playing speed of 30 inches per second. Over the years this has been progressively reduced, each time by a factor of two, as the technology improved, so that now we have tape speeds of 15, 7½, 3¾ and 1⅞ inches per second. The metric equivalents are 38, 19, 9.5 and 4.8 centimetres per second respectively.

TAPE TRACKS

Another way of obtaining more recording time from a reel of tape is to divide the width of the tape into two or four tracks, each carrying a separate recording. These are often referred to as half track and quarter track recordings respectively. To avoid picking up unwanted signals from the adjacent track a black space, or 'guard band' is left between tracks.

The tracks are used one at a time in a monophonic recorder. Thus a quarter track recorder could play track one on the first pass through the machine. The full reel of tape on the right-hand reel would then be turned over and moved to the left-hand position and track four would be played. The reel would be turned over again and moved to the left-hand position. Now a switch is operated to activate the play head for track three. When this has been played the tape is turned over and returned to the left-hand side for the last time and track two is played.

A stereo recorder uses track one for the left-hand channel and track three for the right-hand channel. On the second pass track four carries the left-hand channel and track two carries the right-hand channel

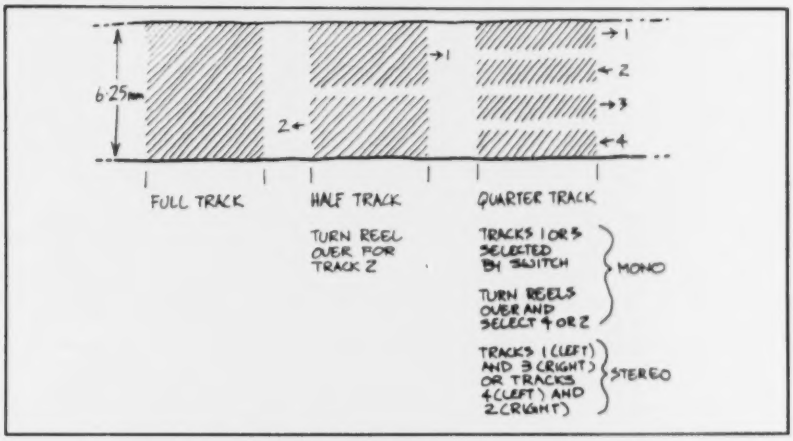


Figure 6.4 Track configurations on open reel tape

THE COMPACT CASSETTE

Tape recording remained the preserve of the professional and the hobbyist until the advent of the 'compact cassette'. This removed the need for the fiddly business of handling the tape itself and threading it correctly.

To minimise size, the tape width was reduced to 4 mm (from 6.5 mm used on the open reel) and the tape speed was fixed at the seemingly slow speed of 4.75 cm/second.

The tape is wound on the left-hand spool with the coated side facing outwards. This means that the tape coating is accessible to the heads and to the pinch wheel which can project through the windows in the edge of the cassette. The left-hand window accommodates the erase head.

The central window is used by a head which acts as either the erase head or the play head as required. (Very few cassette machines separate record and play heads.) Notice the pressure pad behind the tape in the central window which has to be fitted to every cassette. This is a small piece of soft material mounted on a spring. When the centre head projects into the cassette to play or to record, the tape is sandwiched between the pad and the head and good contact is assured.

The right-hand window gives access to the pinch roller which presses the tape against the capstan. Evidently the capstan must be behind the tape. If you look at a cassette you will see holes in the top and the bottom of the casing which allow the capstan to pass into

the cassette behind the tape and opposite the position of the pinch roller.

A similar pair of holes can be seen near the window of the erase head. These are not used until the tape is turned over to play the second side. Then they accommodate the capstan.

Two further pairs of holes can be seen in the top and bottom of the cassette. They are basically square in shape with rounded corners and are provided to locate the cassette on fixed pins in the recorder so that it is accurately positioned relative to the mechanism. Some recorder manufacturers have chosen not to use this location device.

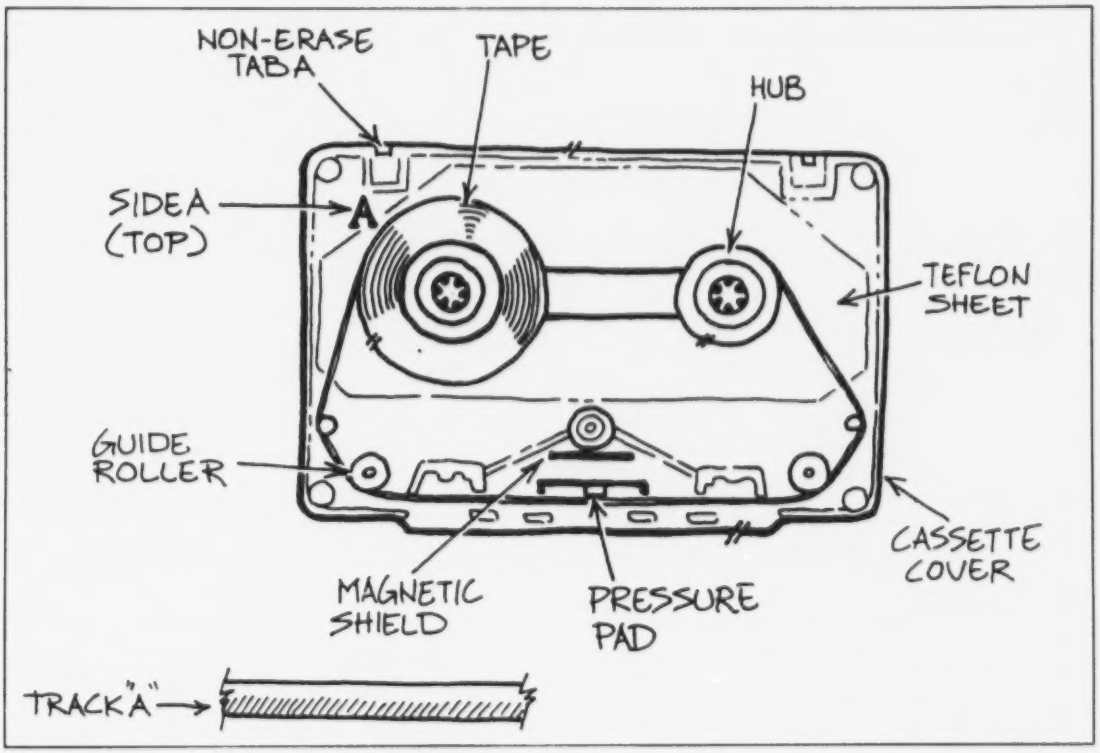


Figure 6.5 The structure of a compact cassette

Many machines are fitted with a pause button. This simply pulls back the pinch roller so that the tape stops instantly while remaining in the play or record mode as the case may be. When the pause button is released the tape is again instantaneously recording or playing. This is a very useful control if you wish to interrupt a recording briefly or if you are editing tape by copying selected parts of an original recording on to another tape.

If you now look at the edge of the cassette (opposite to the edge which has the windows) you may find two more apertures near the corners of the cassette - or they may be masked with flaps of plastic. If the holes are covered you can record on to the cassette. If they are open the recorder will sense this and will not record. In this way a wanted recording can be protected against accidental erasure. All that is required is for the plastic flaps to be removed after the recording has been made. If you change you mind and wish to record on the cassette again at a later date the holes can be covered with adhesive tape. All commercially recorded tapes are sold with protection windows open.

CASSETTE TAPE TRACKS

Track one, which is on the lower half of the tape is recorded first. The cassette may then be turned over and track two recorded.

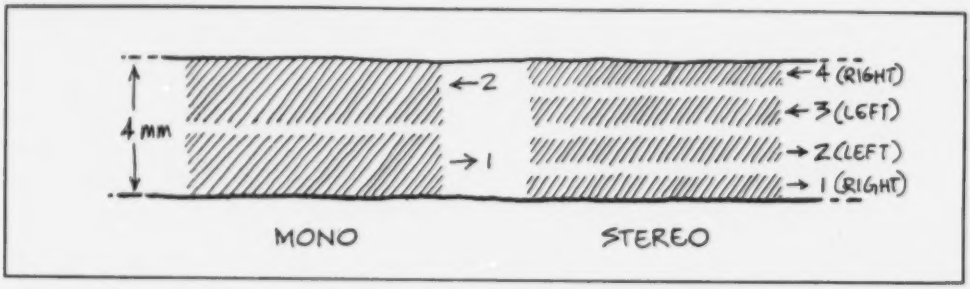


Figure 6.6 Cassette tape tracks

For stereo recording each mono track is divided into two to give a total of four tracks. Track one carries the right-hand channel and track two the left-hand channel. When the tape is turned over track four provides the right-hand channel and track three the left-hand channel. This arrangement (which differs from the open reel format) means that a stereo cassette may be played on a mono machine because the play head covers both tracks. Although the sound will not be heard in stereo, none of the music is lost.

THE SEARCH FOR IMPROVED QUALITY

The relatively slow speed and the narrow tracks at first set a limit to the sound quality that could be obtained from cassette tapes. However, the convenience of the cassettes proved so popular that manufacturers set out on a long quest for improved performance. This has been achieved by a series of detail changes to tape coatings and to the way the signal is recorded and played back from the tape. None of these things has affected the basic design of the cassette itself. To understand these changes and the way they affect the users of cassette equipment, we have to be aware of bias, equalisation and noise reduction.

BIAS

It was discovered in the early days of tape recording that it was necessary to add a high frequency signal (well above the audible range) of about 80 kHz to the sound signal at the record head.

If this is not done the recording is weak and distorted. Even the simplest machines must have this high-frequency bias, but as users we don't need to know about it because it does not call for any action on our part. However, different tape coatings need different amounts of bias to give the best performance so on many stereo tape decks we find a switch which must be set according to the type of tape in use. (Some decks are designed to sense the type of tape in use automatically). As there is no such switch on the simplest portable recorders there is no advantage is using expensive tapes on them.

EQUALISATION

When a recording is made the balance between high and low frequencies is adjusted in a

particular way. When a tape is played the balance is restored to its original state. The reason again is that the overall quality of the recording is improved by doing this. The more expensive tapes need a different degree of equalisation and you will find these tapes marked accordingly. The tapes most commonly used require equalisation designated 120μ (μ is the abbreviation for microsecond). Some expensive tapes are labelled 70μ and the equalisation has to be set to this value. If there is no equalisation marked on the cassette it is safe to assume that it requires 120μ.

Some of the earlier stereo cassette decks had separate switches for bias and equalisation. More recent models have one switch which controls both bias and equalisation. Others again sense the type of tape automatically and require no action from the user.

TAPE COATINGS

The magnetic component of the coating on recording tapes was originally ferric oxide and this is still the most common material in use although improvements have been made over the years in such things as particle size and surface smoothness. These types are called type 1.

Another material which gives better performance at higher cost is chromium dioxide (CrO_2). These tapes require more bias than the type I tapes, and a stronger erasing field, and 70μ equalisation to realise their potential. They are called type II.

Just to confuse matters, you will find that some commercial music tapes use chromium dioxide tape but 120μ equalisation so that they may be played on any cassette player.

A type III tape, formerly available, has been replaced by so-called metal tapes which are classed as type IV. On these the coating is a form of pure iron. They need more bias, more erase field and 70μ equalisation. The cost of these tapes is several times that of a ferric tape, but they are capable of much improved performance provided that the equipment is designed for metal tapes and provided, too, that it is operated correctly.

NOISE REDUCTION

A consequence of low tape speed and narrow tracks is background hiss, which engineers call 'noise'. Various techniques have been developed to reduce this noise.

They system most commonly used is called Dolby B (after its inventor, Dr Ray Dolby whose company has devised a number of noise reduction systems).

Hiss contains all frequencies, but the ones we hear most easily are the higher frequencies. A lot of audible hiss can be removed by the use of a simple 'tone control' which reduces the higher frequencies present in the signal. Unfortunately, this spoils the quality of the wanted sound, giving it a muffled effect. However, the Dolby B system boosts the higher frequencies in the music before the recording and then cuts down the high frequencies when the tape is played. In cutting down the high frequencies when the tape is played the hiss is reduced but the music is back to normal.

This idea works well in the quieter parts of the recording, but it cannot be used in the loud parts because the tape is already approaching saturation, and any boost would cause distortion.

Fortunately it is not needed in the loud parts because the recorded sound obscures the hiss. Recognising this phenomenon and turning it to advantage, the Dolby B system senses when the music is soft and does its boost/cut on record and playback. When the music is loud it takes no action and so no distortion is introduced.

The Dolby B system is effective and produces a useful reduction in audible background noise. It is almost universally used on commercial cassette recordings. An important point to appreciate is that it must be used on both record and playback. If it was not used when recording there is no point is selecting in on playback. If it was used on recording but the playback machine does not provide Dolby B noise reduction some compromise may be possible by using a tone control to reduce the noise level to some extent.

Most commercial cassette recordings will have been made with Dolby B noise reduction. They can be identified easily by the Dolby logo on the label.

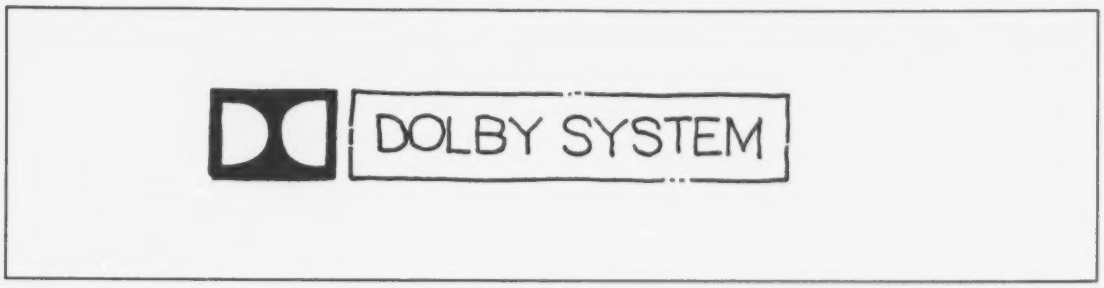


Figure 6.7 The Dolby logo

OTHER NOISE REDUCTION SYSTEMS

The success of the Dolby B system has lead to the introduction of other systems such as Dolby C and dbx offering further noise reduction. None of these is used to any extent for commercial recordings, but they have been useful to people who make their own recordings to play back on their own machine.

PREPARING MATERIAL

At its most basic level, audio tape recording is a very simple process. Take a tape recorder, press the record button(s) and chat into the built-in microphone. This is akin to using an auto-everything snapshot camera. A result is almost guaranteed, but it is unlikely to be mistaken for the work of a professional. On the other hand, you may find that you can derive a lot of pleasure and satisfaction from making a good quality recording which helps your students to learn.

This skill is a combination of several factors including:

- the ability to listen critically and to evaluate a recording;
- an understanding of the technical factors which have a direct bearing on the quality of the recording;
- knowing the capabilities and limitations of different types of equipment;

- knowing how to realise the full potential of the equipment you have available.

In this section the aim is to help you with these points so that you will be able to take pride in producing recordings of simple material, but made to the best quality possible.

LISTENING

What do you hope to hear when you listen to an audio recording? Presumably you would like the sound to be an accurate reproduction of the original, free from distortion, and without added background hiss or other noise. Critical listening is a skill which can be learned quite easily and it is worth the effort to learn to recognise faults in recordings, especially as it will help you to improve your own efforts.

SOME TECHNICAL CONSIDERATIONS

You will remember that the tape on which we record has a plastic base with a coating which can be magnetised. The pattern of magnetisation on the tape constitutes the recording. The degree of magnetisation of the tape has a very direct bearing on the quality of the recorded sound. On the better machines you would be able to control this by a record level control. On other machines the degree of magnetisation is controlled by an automatic circuit, often called automatic level control (alc).

Disadvantages of Automatic Level Control

The circuit has to be designed to react very quickly to a potential overload from a loud sound to avoid distortion. On the other hand, it must not react too quickly to a drop in the sound level or the background noise will surge up in the quieter parts of the recording or in the small gaps between sentences of speech as the alc circuit tries to maintain a constant level.

Consider what happens, for example, when you try to record a lecture when the microphone has to be placed to pick up contributions from the audience as well as the lecturer. All goes well until someone near the microphone emits a loud cough. The alc circuit responds by turning down the level and the lecturer's voice is suddenly faint, returning slowly to normal perhaps over a period of several seconds.

Machines which can be used without automatic level control will have one or two volume unit (VU) meters of some sort, depending on whether it is a mono or stereo machine. Older machines will use a swinging needle meter while newer ones use an illuminated bar. In both cases, the larger part of the display on the left represents the normal range of operation. The remaining sector on the right dictates when there is a danger of overload and distortion. You adjust a record level control so that the meter movement covers the appropriate part of the scale.

Sometimes a VU meter reveals the interesting fact that our particular arrangement cannot provide enough record level, even with the control turned to its maximum. A common example of this is the use of a microphone connected to a stereo tape deck. The microphone circuits provided in these units are often too insensitive to provide correct recording levels. A solution to this problem is given in the section on 'equipment problems and solutions' below.

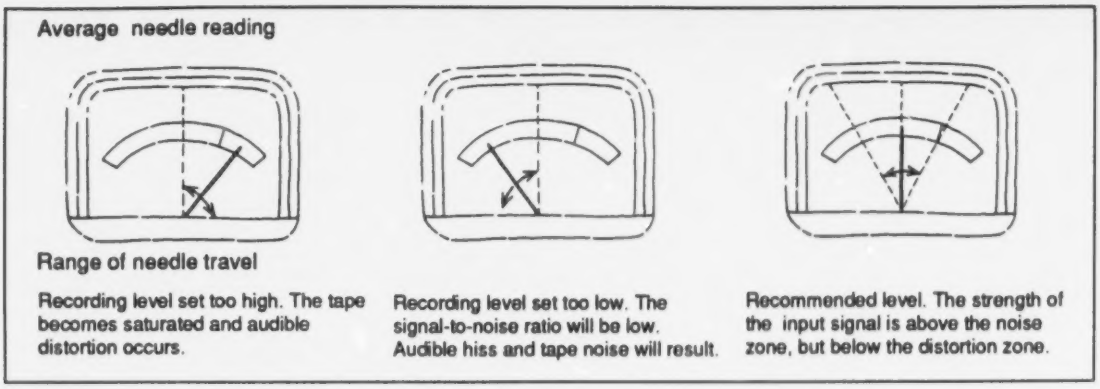

Average needle reading
Range of needle travel
Recording level set too high. The tape becomes saturated and audible distortion occurs.
Recording level set too low. The signal-to-noise ratio will be low. Audible hiss and tape noise will result.
Recommended level. The strength of the input signal is above the noise zone, but below the distortion zone.

Figure 6.8

Tape Speed and Tape Tracks

Another aspect of tape recording is the effect of tape speed on recorded quality - the higher the better. The number of tracks the machine records on to the tape also has an effect on recording quality.

The more tracks you have, the narrower each will be and the worse the sound. The effect of all of these factors can be thought of very simply by saying that the greater the area of tape used for a recording, the better the sound quality, other things being equal. So, running the tape faster should improve the quality of the sound, as should increasing the width of the recorded track.

This is the basic reason why an open reel tape recorder is always potentially better than a cassette machine because it offers a choice of tape speeds and the tape is wider.

Cassette Recording

In the long battle to improve cassette performance we have seen a proliferation of tape coatings and noise reduction systems, each making some new demands on the hardware if the improved technique is to be used. An inspection of the switches on the front panel of a recorder will soon reveal which tapes and which noise reduction systems it will work with.

The Microphone Matters

Recording at its most basic level uses a recorder with a built-in microphone. In cheap recorders, the microphone is not likely to be of a good quality, but it is ideally placed to pick up motor noise to add to the general level of hiss and hash produced by such a machine.

Usually a remarkable improvement can be achieved on a simple tape recorder by plugging in a separate microphone. This automatically disconnects the internal microphone. Of course, the better the external microphone, the greater the improvement. If you have more than one it is worth trying them in turn as microphones, like loudspeakers, have their own characteristics or 'personalities' and you may find that one is clearly better than another in a particular situation. Unfortunately, there is an increasing tendency for manufacturers to leave off connector sockets for any extra inputs or outputs and you may find that there is no provision for connecting an external microphone on the more recent machines.

While an external microphone disposes of the problem of motor noise, the basic problem of background hiss remains. To minimise this you must use a recorder with noise reduction and be careful to operate it at the correct recording level. Noise reduction is usually available only on stereo cassette decks. By far the most common noise reduction system used is Dolby B, but other systems like Dolby C, and dbx are also used.

You may encounter a technique called Dolby HX Pro, which is not a noise reduction system, but a method of improving cassette recording quality.

Microphone Mono Recording With a Stereo Cassette Deck

The advantages of using a stereo cassette deck are that it will record a wider range of frequencies with less distortion than a simple cassette recorder and it will offer noise reduction. However, there are some other additional complications which arise if you are recording from a single microphone, as you are likely to be if you are making a voice recording.

A stereo cassette recording is made on half the width of the tape which has been further subdivided into two tracks, one for the left channel, and one for the right. A standard cassette recorder cannot access these tracks separately. When you operate the record button(s) both tracks will be in the record mode. If your stereo cassette deck has provision for microphone input, it normally is in the form of a pair of sockets, one for the left channel and one for the right. You can plug your microphone into the left channel (say) and make your recording, but when you play back the tape you will get voice plus hiss from the left channel and more hiss from the un-recorded right channel. A solution to this problem is given in the section on 'equipment problems and solutions' below.

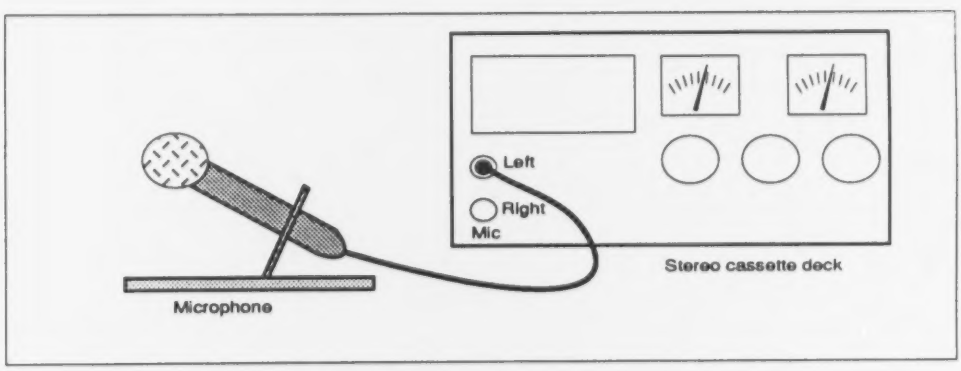


Figure 6.9 Not a good way to connect a microphone to a stereo deck

Stereo Recording From Microphones

So far we have been discussing the use of a stereo recorder, not to make a true stereo recording, but to obtain the advantages of noise reduction and generally higher quality that a stereo deck offers even with a single microphone.

How is the situation changed if we want to record in stereo?

For microphone recording we must either use a stereo microphone - which is really two

microphones in one casing - or two separate microphones. Either way, we shall then have two outputs which can be connected to their respective microphone input sockets.

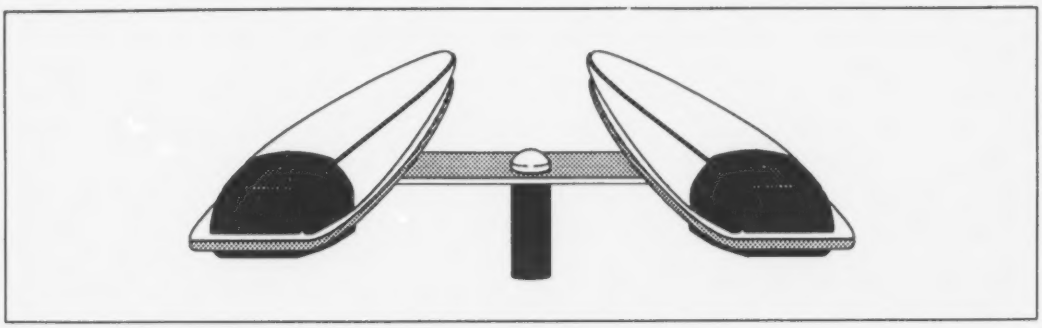


Figure 6.10 Mounting microphones for stereo recording

The Audio Mixer

With a microphone or another good quality signal you can make excellent recordings. But you need more if you intend to record a voice and some background music, for example. Although it is possible to have some music picked up by the microphone as well as the voice, the effect is very unsatisfactory in the same way as it is unsatisfactory to copy a tape using a microphone placed adjacent to the speaker. An audio mixer is needed to do this job to a satisfactory standard.

As its name implies, this unit mixes two or more sound inputs together and allows you to control the volume of each sound independently of the others. For example, you can fade down some music to background level, fade up a microphone to allow some commentary, then fade down the microphone while fading up the music to the original level.

Alternatively, you can record a group of speakers so that each has their own microphone and fader on the mixer. This allows you to balance the speakers against each other in a very flexible way.

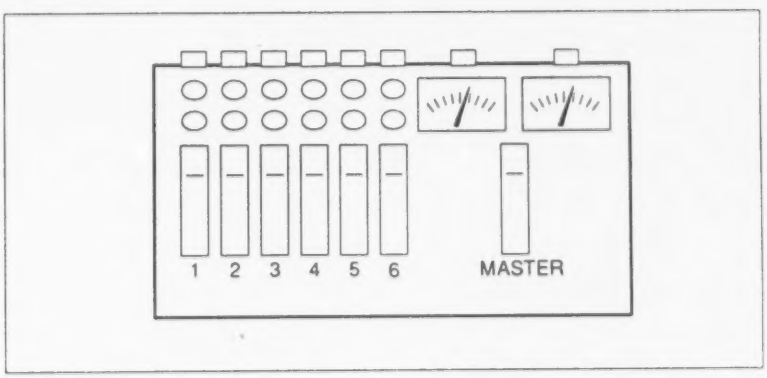
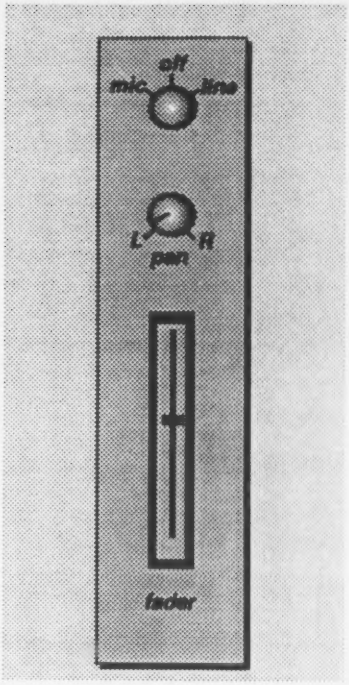


Figure 6.11 Representation of a simple audio mixer. This one has six channels, so it can control six mono inputs or three stereo inputs, or a combination of mono and stereo inputs



The controls for one channel are arranged as shown in the diagram. At the top there is a switch to set the input for microphone or line level signal. Below this is a rotary control called a 'pan pot'. When this is turned fully to the left, the signal from this channel is fed to the left output. When it is turned to the right, the signal goes to the right output. At intermediate positions the signal is split between the two outputs in such a way that turning the pan pot makes the sound appear to move from left to right (or vice versa).

The fader is below the pan pot. This is usually a slider control. If you need to fade two or more channels at once it is easier to do it with slider controls than by turning knobs.

The mixer is fitted with two VU meters, similar to those used on some tape recorders, to monitor the level of the left and right output signals. Below these is a master fader which fades the mixed output up or down. A socket is provided for headphones with its own volume control which does not affect the output level. More elaborate mixers have controls to adjust the frequency response of each channel, and they have many more channels than our simple example.

Figure 6.12 Mixer controls for one channel

Connecting the Mixer

If you wish to connect a source of background music (say a CD player) and a microphone through the mixer, that can be done fairly simply.

A compact disc player would have line level outputs and these would occupy a pair of channels on the mixer. The inputs for these channels must be switched for line level. In the diagram (Figure 6.13) the CD player has been connected to channels 1 and 2. If the LEFT signal goes to channel 1, the pan pot should be turned anticlockwise to direct this signal to the LEFT output of the mixer. Similarly, the pan pot for channel 2 is turned fully clockwise to direct the CD RIGHT signal to RIGHT output. If you don't do this correctly, your stereo output from the CD player will come out of the mixer as a mono signal and much of the quality will be lost.

It is usually convenient to use a mono microphone for the voice. This could be connected to channel 5 or 6. Now the pan pot must be turned to its central position so that the signal is sent to both the left and right outputs in equal proportions. The effect will be that the sound picked up by the microphone appears to come from the centre.

The outputs from the mixer are fed to the tape deck LINE IN sockets for recording.

Some mixers provide phono input circuit on some channels. These must be used if you wish to connect a record turntable pickup to the mixer.

Monitoring the Mix

It is essential to listen to the mix as you do it as there is no other way to tell whether you are getting the effect you want or not. Headphones can be connected to either the mixer or to the recording deck. It is preferable to plug them in to the recording deck, as they will then give you the sound at the end of the system, just before it is recorded. This also allows you to hear your recording played back without changing connections.

Many open reel recorders are three head machines, which allow you to play back the recording a fraction of a second after it is made. Don't try to do this as you are talking through the microphone though, because the small delay as the tape passes from the record head to the play head makes it impossible to speak fluently.

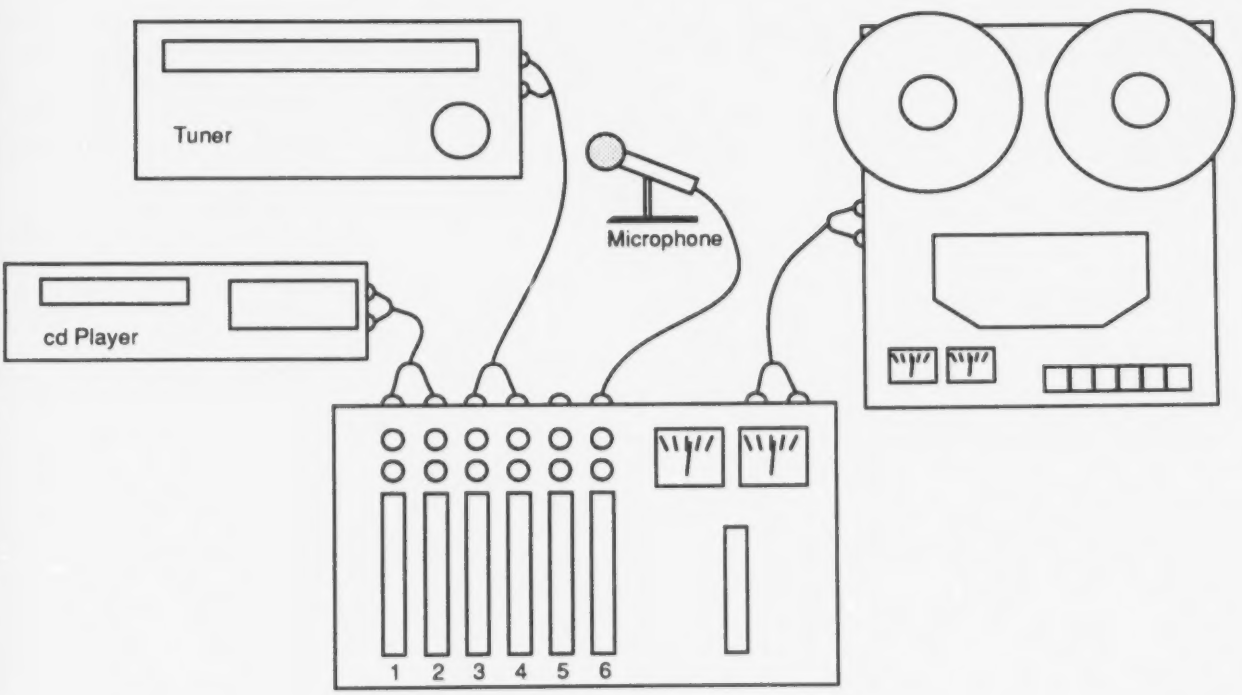


Figure 6.13 A simple mixing set up with a sound source (CD player) and a microphone fed through a mixer to a tape deck

How to Mix

One use for a mixer is to balance the outputs of several microphones. In this case the faders are adjusted until the required balance is achieved. It probably helps to put a temporary label on each fader so that you know which fader goes to which microphone.

When mixing voice and music, as often happens in the preparation of audio tapes, you will probably use some introductory music which then gives way to voice and later it is faded up again.

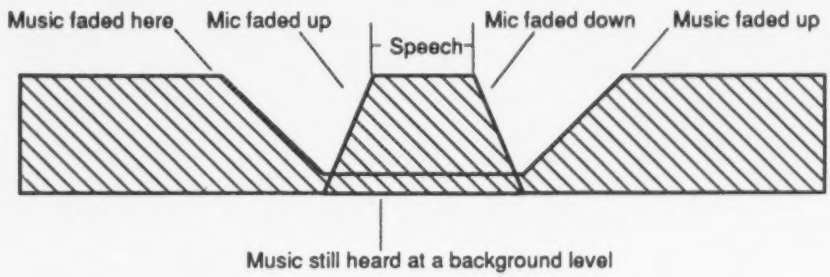


Figure 6.14 Graphic representation of what happens when music is faded to allow the voice to be heard

Assuming that you have a stereo music source, the two associated faders will have to be faded up to give the correct recording level for the introductory music. When the voice is introduced, the music is gently faded down to a lower level so that the voice can be heard - but not so much that we lose the thread of the music. The microphone fader is not brought up until the microphone is about to be used, to avoid picking up unwanted noises. However, it must be turned up rapidly when it is needed so that the opening words are not lost. It is maintained at full level until the voice has finished and then faded out rapidly. The music is then faded up to its normal volume at the same moderate rate that it was faded down.

How to Fade (and When to Fade)

Sometimes you need to fade sound up or down when it is not being mixed with something else. You can do this with a mixer or just with the record level controls on the recorder. Suppose you need a few seconds of music at some point in your program, maybe to set a mood, maybe to avoid a long silence. If you are using the start of the music you have a choice whether to fade it in or start it at the final volume. But if you are using some music which is not at the beginning of a piece, you must fade it in. Similarly, if the music does not conveniently finish at the end of your chosen period, you must fade it out.

A fade in can be done fairly quickly, but a fade out needs more care. It can start quite quickly, but the final stages of the fade should be taken quite slowly.

Just as there are times when you must fade, there are also times when you should not. If you use music at the beginning of your program, use the beginning of the music, at normal volume. To fade it in would weaken the effect. Fade it out or down at the appropriate point. Using the same piece of music at the end of your program improves the shape, but you should select the end of the music. Fade it in and keep it at normal volume until the last echo has died away; then fade as quickly as you like.

Recording Quality

When recording music from disc or tuner most of the measures necessary to obtain good sound quality have already been taken for you by the originators of the material. All that is left for you to do is to make absolutely sure that you are using the correct record level. If you fail to do this, the fine quality of the original will be lost.

The fader settings that give you the correct level from the compact disc may well be different from those needed for the tuner, but this is easily managed by watching the VU meters on the recorder as you listen to the sound. Your judgement is needed to tell whether the sound at any moment is intended to be loud, giving a good deflection on the meter, or is intended to be soft, giving a much smaller deflection. Provided the meter needle only touches the overload region on the loudest sounds, the adjustment is correct.

When recording with the microphone you have to give some thought to finding the best position for it. You will probably use a directional microphone to cut down on unwanted noises, so it is important that it is mounted in such a way that it is pointing towards the sound source. To achieve the correct record level you may need to position the microphone not more than 150 mm away. On the other hand, if it is too close you may get undue emphasis of consonants - the 'p-blasting' effect.

EQUIPMENT PROBLEMS AND SOLUTIONS

Using a Single Microphone with a Stereo Deck

Somehow we have to find a way of connecting our single microphone to both the left and the right hand inputs. The simplest way of doing this is to obtain (or make) a Y adaptor. The microphone is connected to a matching socket and the two plugs carry the same signal to both the left and right input sockets.

If the microphone is feeding the tape recorder via an audio mixer with stereo outputs there is no problem as the mixer will convert the single input to two outputs.

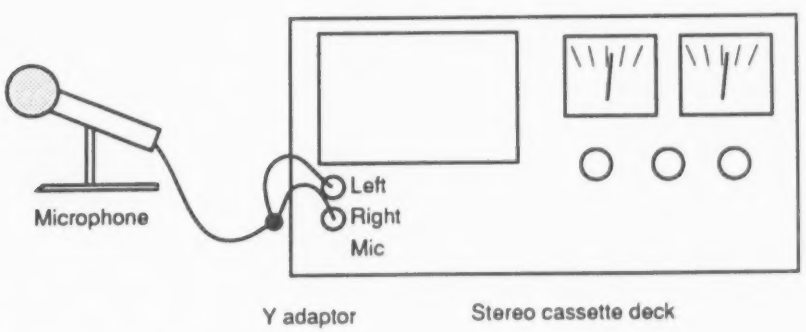


Figure 6.15 Connecting a single microphone with a Y adaptor

Insufficient Record Level When the Control is Set to Maximum

Possible solutions to this are to:

- place the microphone closer to the sound source;
- use a microphone with a bigger output;
- use the LINE IN sockets on the tape deck.

No Microphone Inputs on the Tape Deck

Stereo tape decks are starting to appear with no microphone inputs. However, we can rely on finding LINE IN sockets, so we have to find a way of amplifying the microphone output to line level. A stereo audio mixer is a simple solution, if available. If it is not available, we have to look around for anything with a microphone input. This could be a public address (PA) amplifier, a simple cassette recorder, or even a film projector.

Whatever you use would have to be checked to see that it did not introduce extra noise or hum. Its output would carry a label such as Speaker or Headphone and it would be connected via a Y adaptor to the two LINE IN sockets of the cassette deck.

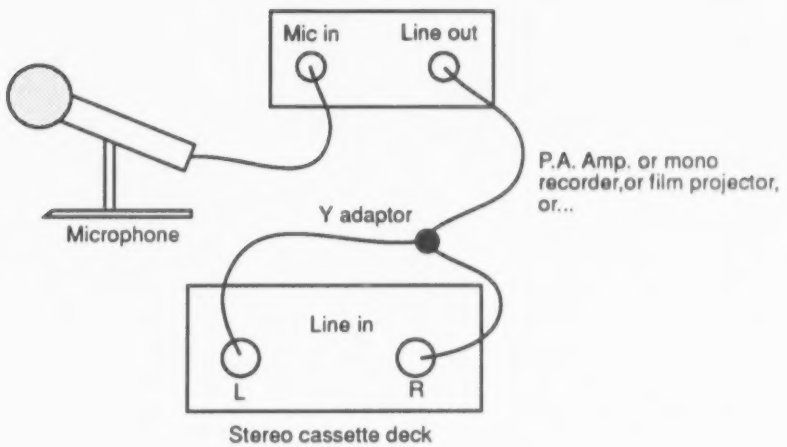


Figure 6.16 Connecting a microphone when no microphone inputs are available

TIPS ON RECORDING

- Bring the microphone close to your mouth - within 30 cm.
- Do not speak directly into the microphone, but rather speak past it. This reduces the 'p-blasting' effect associated with some consonants, and the hissing sounds in sibilants like 's'.
- Place your script on a reading stand so that you can speak without lowering your head.
- Use a recorder which has an instantaneous pause button or lever. This will avoid recording a clicking noise onto tape each time you stop or start the recorder.
- Be sure to turn off fans or any other apparatus which makes noises which can be picked up by the microphone.
- Have a glass of water handy to 'lubricate' your voice, should you need to.
- Proof-listen to your tape on completion. Listen to the tape while following with your script to make sure that nothing has been left out.
- Work from a general script. This will help you to avoid awkward pauses and confusion, and allow you to concentrate on delivering an interesting and comprehensible presentation.
- Allow time on your tapes for students to react to, and act upon your directions. This may involve asking them to stop the tape and to restart it when the task is complete.
- At the beginning of the tape, identify it and give all of the directions to the listener.

CARE AND STORAGE OF TAPES

It is often feared that tapes will deteriorate with repeated playings. In fact there need be no appreciable loss of magnetism over time and no matter how often the tape is played the noise level need not rise if your tapes are cared for properly. However, damage can be caused when tapes are left incorrectly stored.

Precautions to be observed when handling and storing tapes are:

- do not leave tapes in the immediate surrounding of stray magnetic fields such as electric bells, magnetic door catches on domestic refrigerators, etc. The magnetic fields from these devices can add noise or print through to your tapes, or even partially erase them;
- store in temperatures between 20 degrees C and 25 degrees C within a humidity range of 40 - 60 percent;
- avoid storing unboxed reels or cassettes of tape. Store them in the containers in which they were supplied;

- always store boxes of tapes on the edge, as if they are stored flat the weight may distort the plastic reels with resultant damage to the tape.

- play the tapes occasionally to relieve any strains in the tape and to avoid 'print through'. 'Print through' or interference can occur from one section of a tape to another when the tape is stored. Manufacturers attempt to guard against this, but attention to:

  (a) occasional rewinding; and
  (b) correct level of recording (i.e. no overloading of the tape)

  will assist greatly in minimising this condition;

- wind the tape evenly;

- keep both the tapes and recorders free from dust;

- keep the heads, pinch rollers and capstans on your machine scrupulously clean;

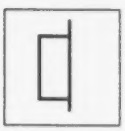
- if a tape has been stored and not played for some time rewind it once before using. This will relieve strain.

INTERNATIONAL SYMBOLS

The following symbols can be found on tape recorders. These are standard international symbols.

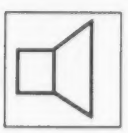
Monophonic

Stereophonic


Earphone

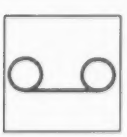
Headphone

Headset

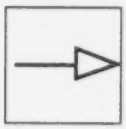

Loudspeaker

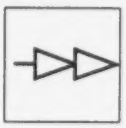
Microphone

Pick up for disc recorders


Tape recorders

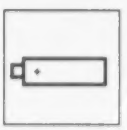
Recording on tape


Normal forward


Fast forward

Stop

Pause

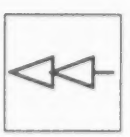

Positioning of cell

Alternating current

Treble

Bass

Aerial


Rewind

ADVANTAGES AND DISADVANTAGES

ADVANTAGES

Playback equipment is easy to use

Generally, all that is required is to insert a cassette into a player and press the play button.

Equipment is compact and portable

The machines are small enough to be easily carried anywhere and used in individual study areas.

There is a long life expectancy of both the tape and the recording

Tapes can be damaged, but with normal precautions, neither playing nor storage damages the tape.

Duplication is easy and economical

A wide range of simple to use tape-duplicators is available, with the better quality machines duplicating at high speeds with no appreciable loss of quality.

Tapes offer excellent means for the individualisation of instruction

Stored sound is available for replay by students at times, places and frequencies suitable to themselves.

DISADVANTAGES

Achieving a high technical quality requires some sophistication of equipment and operation

Low budget audio recordings are likely to have distracting background sounds and uneven recording quality. To achieve quality consistently requires good operator skills and better equipment.

It is difficult to index recorded material

Most digital counters are inaccurate, and there is no consistency between machines.

Some machines have limited output

Most cassette recorders do not have enough output for classroom use - they are more suited to individual or small group use. Extension speakers may improve quality and volume, but amplifiers may have to be used in some situations.

Fixed rate of information flow

Although most machines have a preview function, it is not really a browse facility. It is easy to miss material in this mode.

7. THE 35mm SLIDE PROJECTOR

DESCRIPTION

Slide projectors have a lot in common with overhead projectors and motion picture projectors. In each machine an image is stored on a transparent medium which is illuminated by a bright lamp. The light which passes through the image is collected by a projection lens which projects an enlarged image of the transparency onto a screen.

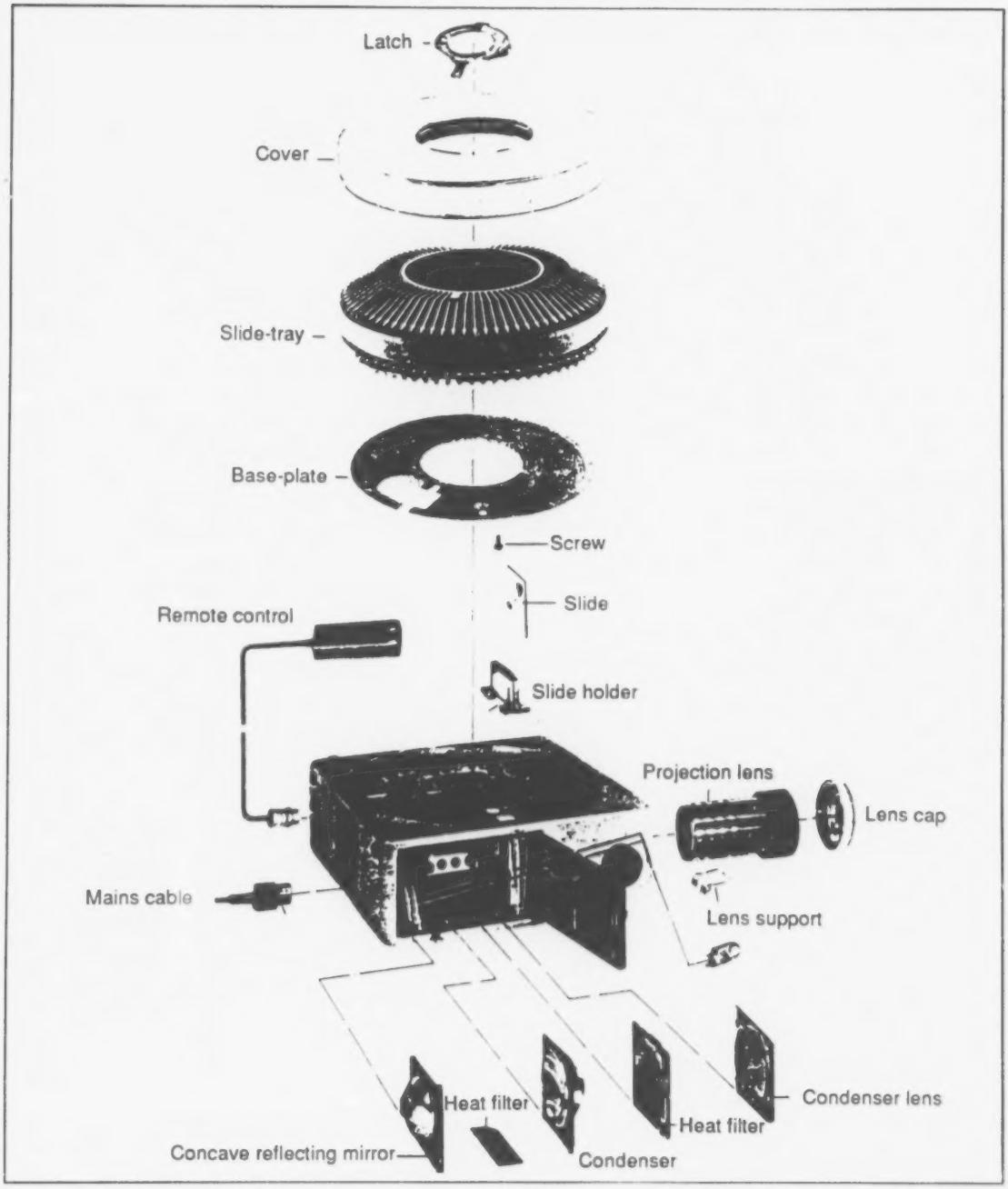


Figure 7.1 Exploded diagram of a Kodak carousel 35mm slide projector

The illustration shows the elements of a Kodak carousel slide projector. The slide carrying the transparent image is supported in a slide carousel. Note that the slide will be upside down because the projection lens will project an inverted image of the slide.

The lamp emits light in all directions, but only the light passing through the slide contributes to the projected image. The condenser lenses collect the light and concentrates it on the area of the slide.

The projector is focussed by adjusting the distance between the slide and the projector lens. A coarse screw thread on the lens casing causes this distance to change as the lens is turned.

Unfortunately, lamps emit heat as well as light. To prevent overheating of the slide a heat filter is placed between the lamp and the slide. This absorbs most of the infra-red (heat) radiation from this side of the lamp. In addition, there is a fan to prevent the projector and the slide overheating.

Screw adjustments on the front corners of the projector adjust the tilt of the projector and therefore the height of the image projected onto the screen.

PROJECTOR LAMPS

A lamp designed for use in a projector has to meet rigorous requirements. It must provide as much light as possible, while still having a reasonable life. To some extent these two requirements conflict. The filament must be shaped to ensure that the light emitted will be uniformly distributed over the total area of the transparency.

Older projectors incorporate a lamp design which uses a type of construction similar to a domestic lamp. Because the filament is run as hot as possible to achieve maximum light output, some of its material evaporates and then condenses on the relatively cool glass envelope which surrounds the filament.

This has two consequences. Firstly, the glass is darkened by the thin metallic coating which forms on it, resulting in reduced light output. Secondly, the filament is weakened by this continual evaporation, so that eventually it breaks. This is most likely to occur when operating, because the filament is most fragile while it is hot. Thus it is very important not to jar a working projector.

A more recent design uses quartz halogen lamps. The envelope is made of quartz which has a higher melting point than glass. This allows the filament to run at a higher temperature, which has the advantages that there is much more light output for a given electrical input and the light is nearer to daylight in colour. While the filament, surrounded by a halogen gas, is still prone to evaporation, the vapour does not condense on the very hot quartz surface. Instead, it returns to the filament which has a much longer life than the older type of lamp while actually producing a higher light output.

The relatively long life of a quartz halogen lamp can be reduced by touching it with bare fingers. The natural oils of the skin react with the quartz at high temperatures to cause premature failure. This means that these lamps, which are commonly used in many projectors and specialised lighting units must never be handled directly. Hold them through their packaging or, say, a protective tissue. If they are touched accidentally, it is possible to wipe the oils off using methylated spirits and a tissue, but it is very important

that they be allowed to dry thoroughly before they are put back in the projector and turned on.

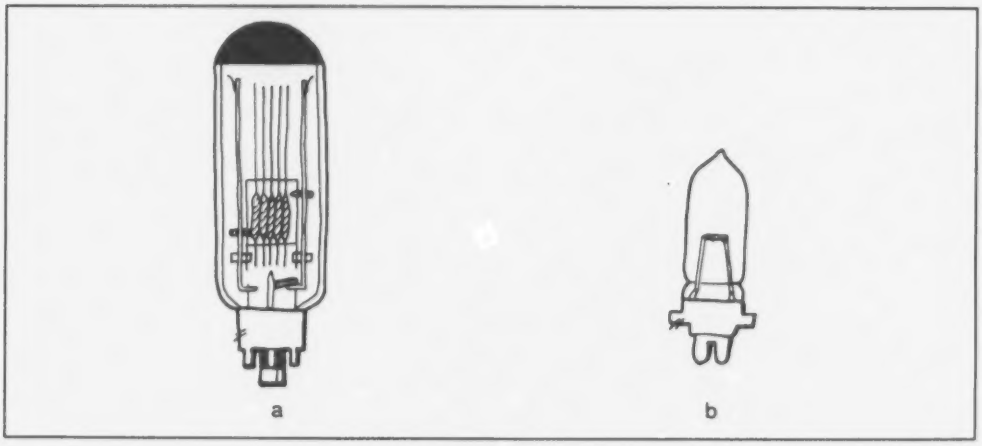


Figure 7.2 Projector lamps. Older, incandescent style (a) and Quartz halogen type (b)

SLIDE ORIENTATION AND SLIDE SPOTTING

One practical problem associated with using a slide projector is making sure that the slides are inserted the right way around, because it is possible to insert the slides in eight different ways, and only one of them is correct. When the slide reaches the gate of the projector the image on the slide, as seen from the back of the projector, must be upside down and reversed from left to right if it is to appear correctly on the screen. You can usually tell if the image is upside down or not, but it is not always too obvious if it is reversed left to right. It may help to note that when a slide is correctly inserted in the gate:

- the emulsion (dull) side of the slide always faces the screen;
- if the film maker's name is printed on the slide mount, that should also face the screen;
- if the slide is mounted in a plastic mount which is dark on one side and light on the other, the light side is intended to face the lamp to reflect the heat, while the dark side is intended to face the projection lens, to suppress internal reflections.

To make loading easy for future use, the correct orientation should be marked on the slide mount. The standard convention for this says that if the slide is held in the position it should occupy in the gate of the projector, there should be a mark on the top right hand corner of the mount. If the slide is one of a numbered sequence, you may find it more convenient to use a slide number in preference to a coloured spot.

Most slide magazines and trays are designed to allow the numbers to be checked while the slides are assembled in the magazine.

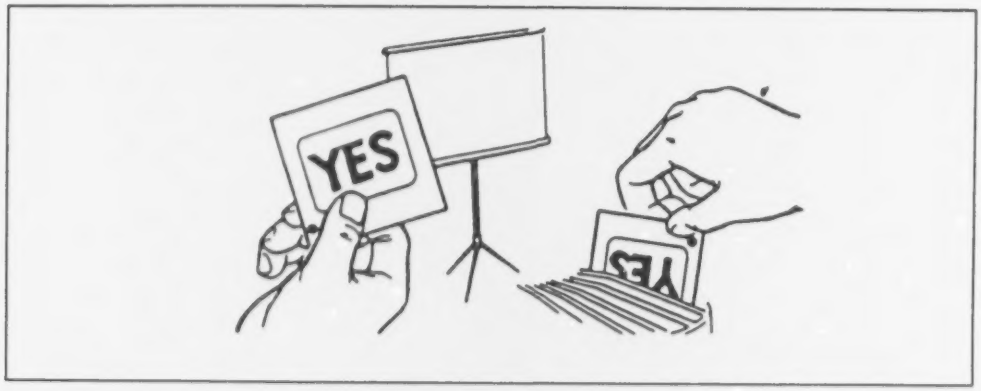


Figure 7.3 Spotting slides for insertion in a slide tray

EFFECTIVE USE OF SLIDES

PHYSICAL ARRANGEMENT OF THE ROOM

Preparing good slides is not enough to ensure that their use automatically enhances the learning process. To achieve maximum effectiveness from your slides you will have to pay the same attention to your projection techniques in the classroom as you did in the slide preparation stages.

Of course, it is important that everyone in the group has an unimpeded view of the image on the screen. To achieve this, a number of factors have to be considered, including:

- the screen type and its placement;
- the projector position;
- the arrangement of the seats;
- the lighting.

Screens

These have been covered in the chapter on 16mm projectors, so all that will be mentioned here is that to achieve optimum image quality for all of the audience, it is important to consider carefully the position of the screen In particular, pay attention to:

- the alignment of the screen. It should be set up at 90 degrees to the axis of the projected image, to avoid keystone distortion.

- the screen height. The bottom of the screen should be at least as high as the tops of the heads of the front row of the audience, to prevent heads from obstructing someone's view.

- stray light. Position the screen to minimise the amount of ambient light falling on it. This may involve placing it with its back to a window where light control is difficult.

Projector Position

The final position of the projector will probably be determined by other things like:

- the position of the power point;
- the position of the screen;
- the focal length of the lens.

If possible, experiment with different positions to ensure that the best possible image is projected and that audience safety is not compromised. Avoid positioning either the projector or any of its associated cords where the audience may bump them or trip over them, especially during an emergency evacuation.

The remote control devices and laser pointers now available mean that you need not stand very close to the projector at all during your presentation. Thus you are able to stand in front of the class, placing you in a better position to gauge their response and to modify the presentation accordingly.

Arrangement of the Seats

Positioning of the seats is important. It's axiomatic that a student cannot learn anything from an image which is not clearly visible. Whether the image is satisfactory or not will be determined by factors including the image size, the type of the screen, the distance from the screen and the angle of view.

The simple way to find out whether a seat is in a good position or not is to arrive in advance of the audience and project some of your slides while you try different seats. If the image is less than adequate you will need to avoid particular seating arrangements.

Lighting

It is best to avoid completely darkening the room, but you do need to have an image on the screen which is sufficiently bright for all of the audience to see it. When facilities for darkening the room are poor, try to minimise the amount of ambient light falling directly onto the screen. This can sometimes be achieved by placing the screen so that it is near a window.

Another technique which will enhance the brightness of the image is to place the projector nearer to the screen. Halving the projection distance increases image brightness four times, so the effect can be quite dramatic. Of course, if you do decrease the projection distance you may have to change the projection lens to maintain an adequate image size. Remember, though, that the larger the image, the lower the brightness will be.

PRESENTATION TECHNIQUES

The actual presentation of your slides in the classroom or lecture theatre needs the same careful planning as their preparation.

Plan the sequence and the associated commentary carefully. If you are not planning a continuous presentation of slides, you may consider using black slides as dividers to separate your material. They are simply pieces of opaque film mounted in a slide frame which can be used to block off light to the screen during the time you are not using slides.

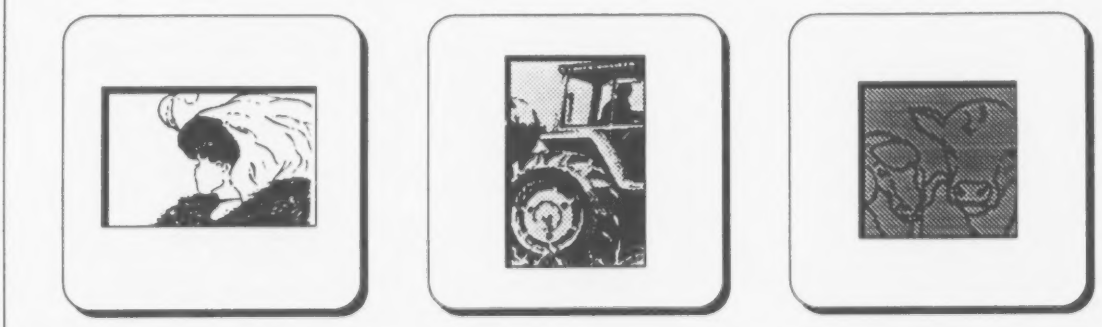
If you have an out-of-date film you can make a ready supply of black slides by exposing the film to light and having it processed normally. Most processing laboratories will be able to provide black slides without much trouble.

Encourage student participation during the presentation. There are various ways of doing this, including asking questions or encouraging comments during the screening or having pre- prepared worksheets which you distribute in advance. This type of decision is best made by the instructor who knows the content and the intended audience. Similarly, the type of follow-up activities you employ will depend largely upon your purpose for using the slides. The only thing which we are sure about is that some form of follow-up activities are essential if the students are going to achieve maximum benefit from your slides.

Keep a close eye on the images as they appear on the screen. It's important that each image be centered on the screen and that it is projected in sharp focus.

The overall success of your presentation as a learning experience for the students will depend upon:

- the content of your slides;
- the technical quality of the slides;
- the introduction to the session;
- the presentation;
- the follow-up.



Common slide formats include the 35mm type, which can have a horizontal or vertical orientation, and the 126 type, which has a square image.

Figure 7.4 Slide formats

ADVANTAGES AND DISADVANTAGES

ADVANTAGES

Individual images can be projected for as long or as short a time as needed

The pace of the presentation is not dependent upon the slides themselves, or the projector.

Slides are small enough to be easily stored, handled and rearranged

A wide range of excellent slide storage systems is available.

Projectors are relatively inexpensive, lightweight, and easy to operate

Projectors are quite easy to carry, and some come with lightweight cases which allow you to carry a set of slides and a pointer quite conveniently.

The room need not be completely dark for projection

It is preferable not to darken the room for several reasons. The audience may become unsettled and they certainly would not be able to take notes.

Preparation of slides is relatively simple

A basic knowledge of photography will be adequate to prepare most slides.

A variety of film stocks are available

Most slides are shot on colour reversal film, but black and white, diazo and litho stock all make attractive slides. You may also be able to produce computer generated slides of high quality.

Slides give colourful, realistic reproductions

Nothing can approach colour transparency film for its ability to reproduce colour faithfully.

Slides are easily revised and updated

A short time spent on a light table will be enough for you to evaluate your slides and see which are due for revision.

Slides are versatile - they can be used for large groups or for individuals

The range of projectors and lenses available make it possible to project in quite confined spaces like study carrels at one extreme and large auditoriums at the other.

Multiple copies are easily produced

Quite often this can be done in-house, but most laboratories have a quick, reasonably priced duplicating service.

DISADVANTAGES

Slides can become out of order

Slides do need to be looked after. A check is needed after each presentation to ensure that all of the slides are still in their correct place.

Slides can be misplaced, e.g. by leaving the last slide in the projector

Similar to above. We all need to develop good habits about checking for missing slides as we pack up.

It is possible to project slides upside down or back to front

This can be overcome by careful spotting of slides, but it does cause embarrassment if you slip up.

Preparation of specialised slides requires some photographic skill and equipment

Close up and copy stand work in particular require some skill and access to appropriate lenses, filters and lights.

SLIDE - TAPE : COMBINING SLIDES WITH SOUND

Slide-tape is an audio visual medium in which the picture is provided by slides, usually in the 35mm format, and the sound is provided from an audio tape, often by an audio cassette.

In its simplest form the slide change is activated by a person watching the programme on an audible cue from the sound track, such as a tone or a bell. The only equipment needed for this simple level is a standard slide projector and simple tape player.

More elaborate apparatus designed specifically for slide - tape uses an inaudible pulse (or cue tone) recorded on the tape to activate the slide change automatically at the correct point in the programme.

ADVANTAGES OF SLIDE - TAPE

At the most basic level, the only equipment you need to make a slide-tape is a 35mm camera and a cassette recorder. The only equipment you need to play this slide-tape is a simple slide projector or viewer and a basic cassette recorder or player. The resulting sound quality will be as good as either video tape or 16mm film and the picture quality will be better than both.

If you have access to a better camera and more elaborate audio recording facilities the quality can be further improved. The equipment needed to record or play a programme with inaudible pulses is less common because it is more specialised in its application , but it is not particularly expensive.

The material cost is comparable with half inch video tape and very much cheaper than any film format.

If you have a video tape recorder and television receiver, a video tape is a very convenient audio visual package to use. However, the capital cost of the two items is considerable and the number of people who can view the programme together is strictly limited. On the other hand, a slide - tape can be viewed by a single individual or by the audience of a large theatre if the theatre is equipped with suitable slide projection and audio amplification equipment.

The basic slide-tape idea can be elaborated almost without limit using multiple projectors, multiple screens and multi-channel sound all controlled by a computer programme to give the ultimate audio-visual experience.

DISADVANTAGES OF SLIDE - TAPE

Only still pictures can be used. How important this is depends very much on the subject matter of the programme. The Grand Prix would lose much of its excitement if presented as a series of still pictures, but a programme on historic buildings does not need moving pictures and would benefit from the very high picture quality available from slide-tape.

Considerable care may be needed to ensure that synchronism is obtained and maintained between the picture and the sound. Here are a few ways that things can go astray:

- if the programme is synchronised manually, the user must recognise each signal and respond appropriately;

- if inaudible pulses are used the user has a choice of methods of starting the program. Either the first slide can be put in the gate of the projector, focussed and the tape started, or the tape can be started and relied on to bring the first slide into the gate. If the user makes the wrong choice, the slides will be out of step from the beginning;

- some slide-tape units are sensitive to the strength and duration of the change pulse. If the pulse is too short, the slide may not change. If it is too long, the slide may change backwards instead of forwards. Pulses recorded on one type of machine may not be effective when played on another, due to incompatibility problems;

- unless care is taken, the tape may become separated from the slides or the slide magazine may exhibit slides which are interchanged, inverted or lost.

AUTOMATIC SLIDE CHANGE

A normal audio recording on cassette tape is made on the lower half of the tape (stereo tracks 1 and 2). Normally, a second recording is made on the other half of the tape (tracks 3 and 4). For slide-tape purposes, the upper half (tracks 3 and 4) may be recorded with slide change pulses which are detected as the audio programme is played, but they do not produce any audible audio output. Since the whole width of the tape has been recorded, it is not possible to turn the cassette over for a second recording.

Another method, which avoids using tracks 3 and 4, is to record the tone as a very low frequency superimposed onto the audio track. When played on a standard tape player, the tone may be audible, but on equipment designed for slide-tape use it can be filtered out with negligible effect on the sound track. Packages which use this method often present the programme with 'inaudible' pulses on one side of the cassette and the same programme with an audible signal on the other side. The user can then choose which to use according to the equipment available.

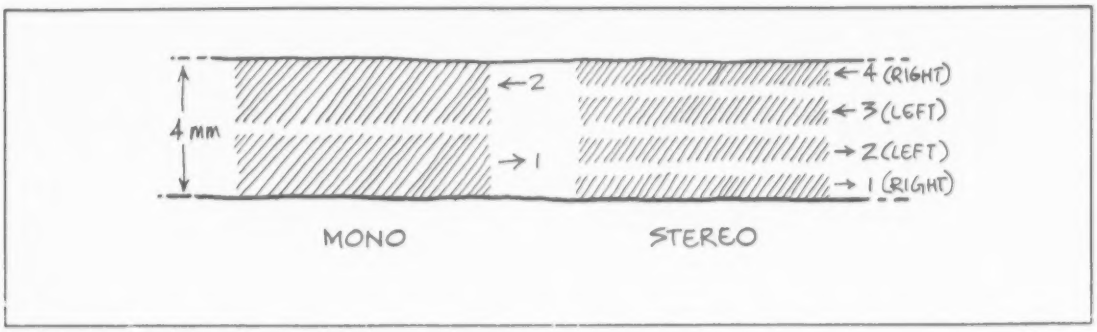


Figure 7.5 Cassette tape tracks

The first method, recording cue tones on tracks 3 and 4, is easier to use when making a slide- tape as the cue tones can be recorded, erased and edited without affecting the audio track. Similarly, the audio track can be edited without affecting the cue tone recording.

EQUIPMENT FOR SLIDE-TAPE

Many remote control slide projectors can be used in conjunction with a cassette recorder fitted with a special play head. This head has one gap which is aligned with the cue track and another aligned with the sound track so that the two signals are kept separate and directed to appropriate circuits for each function. An extra lead connects the cassette recorder to the slide projector to trigger the slide change. The recorder usually has provision for recording the cue tones as well as the sound signal.

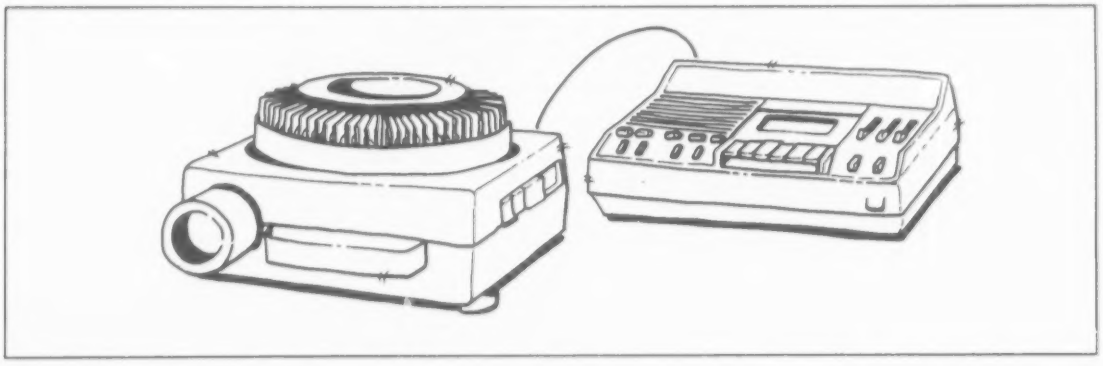


Figure 7.6 Slide-tape presentation using a modified cassette recorder

Another design approach combines a slide projector, a cassette mechanism and a rear projection screen in one unit. This is very convenient for small group use particularly, as no connection or setting up has to be done. This, too, may have provision for recording sound and pulses, and some machines of this type can also be used for presentations to large groups through the use of a mirror which can be used to switch the light path.

Figure 7.7 Self-contained unit for slide-tape presentation

STANDARDS FOR SLIDE - TAPE

In the early days of slide-tape there were many competing systems using different cue signals recorded in different ways. A package produced for one system would not work on another. To help overcome this problem, the Council for Educational Technology in the UK produced standards for slide-tape called Uspec 2 and Uspec 16. (Uspec stands for user specification and many other Uspecs have been produced covering a variety of audio visual matters.) These standards have been more recently incorporated into an international standard, IEC 574-10.

Picking out a few of the more important points, the standards have established the following:

- a slide advance cue tone will have a frequency of 1000 Hz and last for 450 ms (milliseconds);
- automatic tape pause will be signalled by a tone of 150 Hz of the same duration;
- sound will be recorded on tracks 3 and 4.
- cue tones will be recorded on tracks 1 and 2. (There is also provision for cue tones to be recorded on track 1 only);

- the first cue tone will trigger the second slide into the gate, allowing the first slide to be loaded manually and focussed before the cassette is started;

- at the end of the programme, a final cue tone is provided to remove the last slide from the gate of the projector.

USER INSTRUCTIONS

While it is reasonable to expect the producer of a slide-tape to be familiar with the requirements of the standards, it would be unrealistic to expect every user to be aware of them.

Thus, it is particularly important with this medium that adequate instructions should be provided for the user to ensure that the programme is started correctly, seen and heard comfortably, and then made ready for the next user.

CARE OF SLIDE-TAPES

The tape in an audio cassette is well protected, especially when it is in its storage box. Provided it is stored on edge with the usual requirements of moderate temperature and humidity, no extra precautions are necessary, except to ensure that it is kept with the associated slides.

The slides themselves present a greater problem The most compact method of storage is in small boxes similar in size to the cassette box. However, each slide then has to be correctly fitted into a magazine or carousel before the programme can be used. When the program has finished, the slides must be transferred back to the box after use. Sooner or later this is sure to result in slides which are inverted, out of order, or completely lost. Storing the slides in plastic wallets which allows each slide to be inspected without removing it has advantages for some purposes, but still involves much slide handling.

The best solution, although the most expensive, is to keep the slide in a magazine of the type which will be used in the projector. This cost is not high when compared with the cost of the production of a good slide-tape package. This solution also avoids the need to handle any individual slides.

The remaining problem concerns the storage of slides and tape together so that they will not become separated.

Commercially available plastic bags which hang on specially designed library shelves present quite an efficient way of storing the complete slide-tape together as a single unit. Also in common use are cloth covered boxes, designed to be fractionally larger than the slide magazine to provide enough room for the cassette to fit in also. Both of these solutions have the added advantage of allowing room for a script, if you so desire, and copies of associated worksheets to be kept with the slide-tape.

A trip to your nearest TAFE College library will probably show you various alternatives for storage, as this is a problem which librarians and library technicians have to grapple with constantly.

PREPARING MATERIAL - SLIDE PREPARATION

Sometimes you will not have much choice about how you arrange your material for a slide. If you are photographing a land-form or a hair style or parts of an engine for example, there may not a great deal of flexibility available.

This is not the case, however, if you are preparing slides from printed materials. A common mistake in this process is to assume that because something is legible in one medium, it will also be legible in another. Consequently a lot of slides prepared from printed material contain too much fine detail for satisfactory projection.

The best test is to project the slides in the environment you are preparing them for, to check that all of the detail is legible from each seat, but the following guidelines should be helpful if you are preparing artwork for slide originals.

- use a dark coloured background - it is better than black or white.
- include titles to supplement, not duplicate slide data.
- use several simple slides rather than one complicated one, especially if you are going to discuss the subject at length.
- limit each slide to 15 to 20 words or to one main idea.
- use a slide series for progressive disclosure - it clarifies greatly.
- use duplicate slides if you need to refer to the same slide at different times during your presentation.
- include no more than you will discuss.
- don't leave a slide on the screen after discussing its subject.
- use black slides between separate sequences.
- plan your slides for a good visual pace in your presentation.
- words are identified most rapidly when composed of lower case letters, so prepare your originals in lower case.
- leave space - at least the height of a capital letter - between lines.
- use a template with an aspect ratio of 3:2 for your artwork, e.g. 240mm x 160mm would be suitable.
- avoid mixing formats, e.g. vertical with horizontal if you can.

8. 16mm PROJECTORS

DESCRIPTION

A 16 mm projector is actually two machines in one. There is the optical component, which projects the images onto the screen, and the sound component which reproduces the sound track. The light source is a small but powerful lamp (typically a 250 watt quartz halogen type) designed and placed in the machine so that its output is focussed on one frame of the film at a time. The projection lens focuses the image onto the screen.

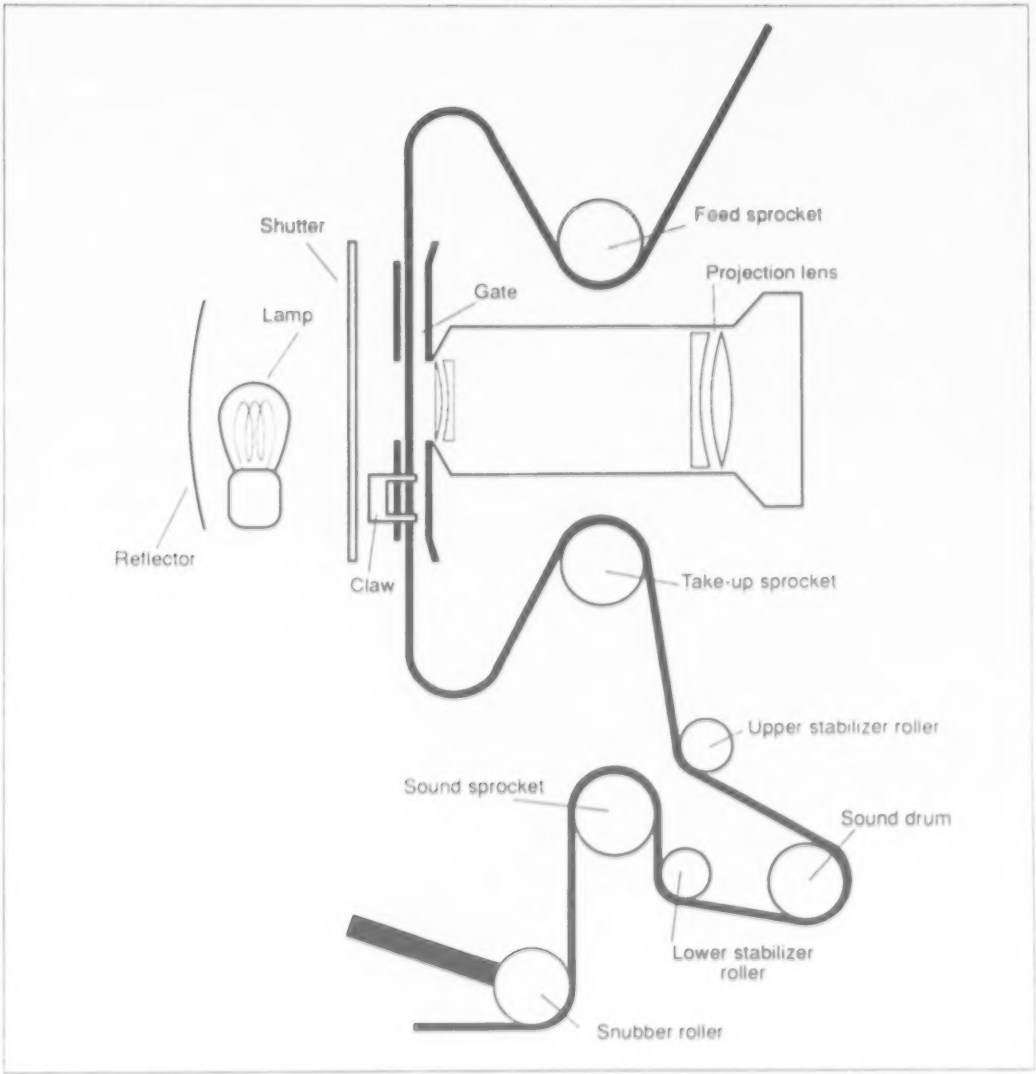


Figure 8.1 The two components of a 16mm projector - the optical and the sound systems

The most obvious component of the optical sound reproduction system is the sound drum. The film is transported at a constant speed around the sound drum with the sound track overlapping the edge of the drum.

The light from the exciter lamp is focused onto the sound track by a sound scanning lens. The density variations in the sound track produce matching variations in the intensity of this light beam as it passes through the sound track. These variations in light intensity are received by a photoelectric device which converts them into corresponding electrical variations. This electrical pattern is then amplified and passed to a loudspeaker which reproduces it as sound.

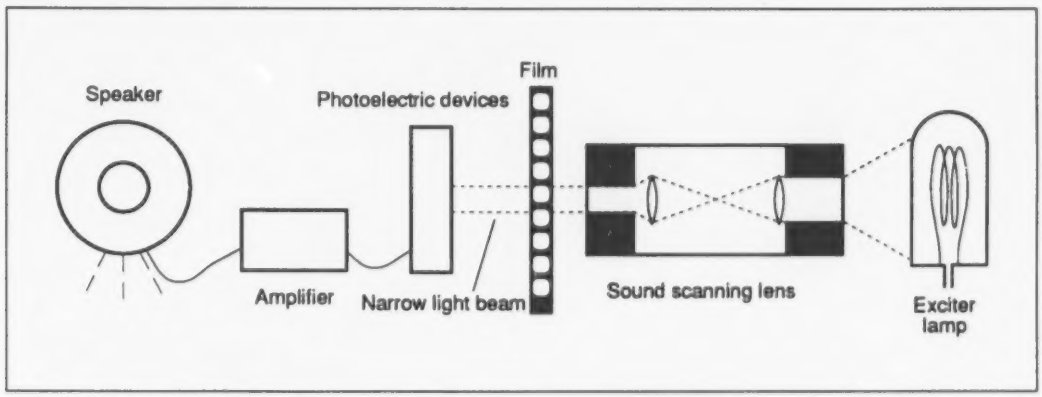


Figure 8.2 The components of an optical sound system

HOW TO USE IT - THE CLASSROOM AS A THEATRE

The ensure the effective use of a room and to facilitate learning, certain projection principles must be followed.

THE ROOM

The room should be large enough to seat the audience comfortably. Allow approximately one square metre per person if you have fixed seating. Also allow for aisle space and the distance which the front row should be back from the screen - the nearest person should be no closer than two image widths from the screen. Similarly, the furthest person should be no further than six image widths from the screen.

It is preferable to darken the room. Roller blinds, venetian blinds and drapes are three common methods used. Complete room darkening is neither necessary nor desirable as some people may become upset in a totally darkened room. When facilities for darkening the room are poor, try to minimise the amount of light falling directly onto the screen. This can sometimes be achieved by placing th screen so that it is near a window.

The room should have adequate ventilation which is not affected by drapes etc.

There should be enough suitably positioned power points. It is not good practice to lay extension cords along the floor where they may cause people to trip during an emergency evacuation.

The acoustical properties of the room should be satisfactory. Each room will have its own acoustical problems. When sound reverberates around a room it becomes less distinct, so bare walls should be avoided if possible. On the other hand, though, the presence of too many curtains and carpet can cause a room to be acoustically 'dead'. If possible, arrange to have the speaker placed near to the screen with some type of sound absorbing material behind it.

There should be an appropriate projector stand.

THE SCREEN

Screen Type

Most screens available in teaching areas, whether portable or fixed, are of the matte white variety. These screens reflect light evenly in all directions and the image appears to be uniformly bright from 'normal' viewing angles, which are up to 45 degrees from the lens axis.

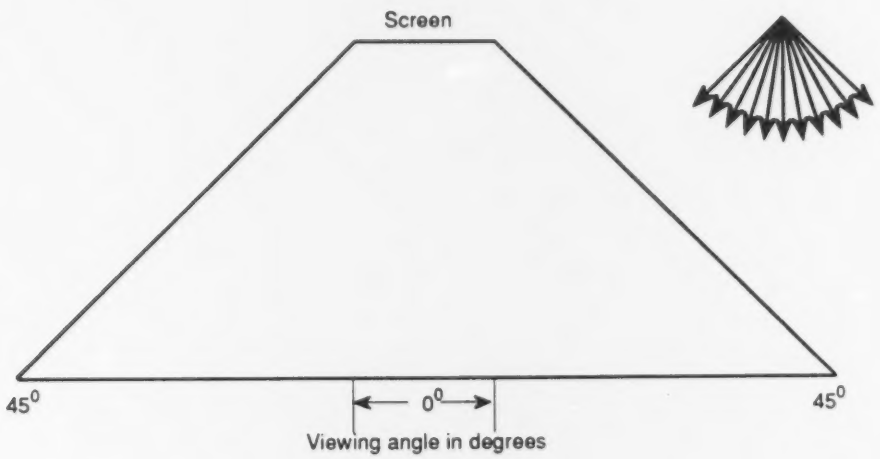


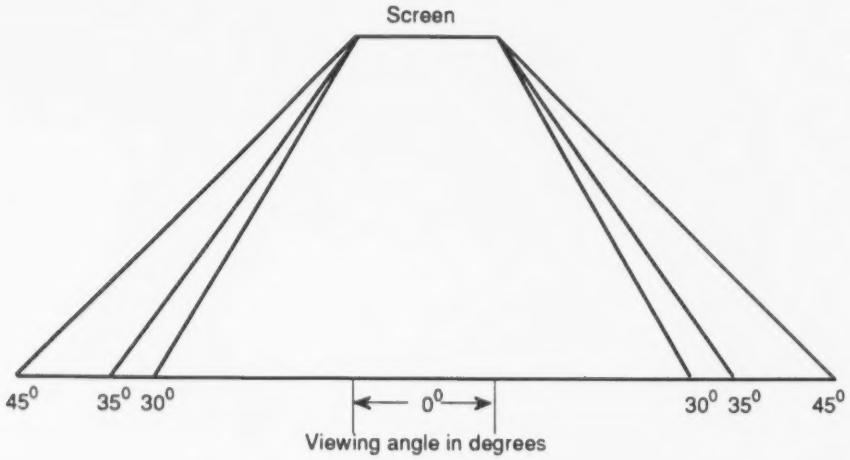
Figure 8.3 With a matte white screen light is reflected evenly in all directions

A good matte screen will produce a sharp, even image with good colour reproduction, but good darkening facilities are necessary as ambient light is also evenly reflected from the screen, degrading the image.

You may also encounter some 'daylight' screens which are designed to produce an extremely bright image when the room cannot be darkened.

Seating has to be arranged more carefully with this type of screen because the optimum viewing angle can be as little as 30 degrees from the horizontal projection axis.

The actual positioning of the screen is not so critical, because ambient light from outside the viewing angle does not degrade the image, but it is necessary for the audience to be practically in front of the screen.



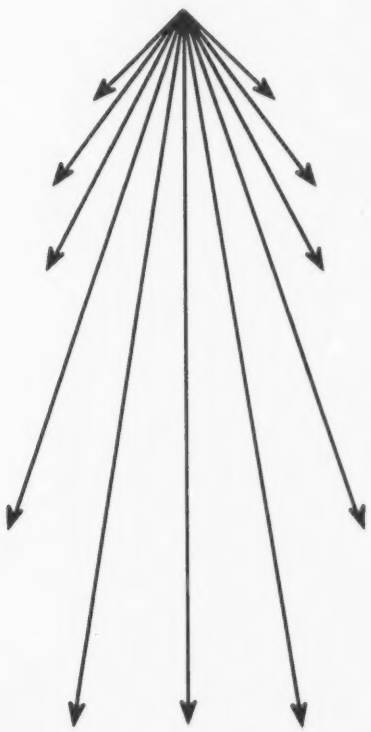


Figure 8.4 The image immediately in front of a good daylight screen is very bright, but the quality falls off sharply towards the edges

Screen Size

To establish the proper screen size for a particular seating arrangement within a room, you can use the following rule of thumb:

The image width should be 1/6th of the distance from the screen to the back row of the audience. For example, if the distance between the screen and the back seats is 12 metres, the screen should be 2 metres wide. Since the height of the image for normal 16 mm projection is 3/4 of the width, the screen should be 1.5 metres high in this example.

Screen Placement

To achieve optimum image quality for all of the audience, consideration should be given to where the screen is placed.

In particular, pay attention to:

- the alignment of the screen. The screen should be set up at 90 degrees to the axis of the projected image, so that keystone distortion is avoided;
- the screen height. The bottom of the screen should be at least as high as the tops of the heads of the front row of the audience, to prevent heads from obstructing someone's view;
- stray light. Position the screen to minimise the amount of ambient light falling on it. This may involve placing it with its back to a window where light control is difficult.

THE FILM

Effective use of film as a teaching medium does not just happen. This involves the instructor and the students in activities both before and after the actual screening.

Teacher Preparation

It is important to preview the film in advance of the screening as well as reading the film guide. This will help you to determine which points in the film are important and to identify any specialist terminology which needs to be explained before the screening. It may be an added advantage to have members of the class present at the preview. They will see the film from a different point of view and they will be able to identify new or unusual words or situations which need to be explained before the screening.

Student Preparation

The film should be introduced to the group and they should understand how the film is related to their studies. Research has shown that increased learning results from film showings if viewers are told in advance why they are seeing the film and what they are expected to learn from it. An 'active' viewing is thus achieved, which is more likely to lead to permanent learning than is a 'passive' viewing.

The Presentation

There are two aspects of the film presentation, or screening which need to be considered, the technical and the pedagogical.

It is important that the picture image be clear, in sharp focus and properly framed during the presentation. The volume should be adjusted so that the whole group can hear comfortably, and of course, the whole audience should be able to see the picture. It is imperative that the projector be cleaned before each screening, to avoid both distracting marks/blurs on the image, and to prevent damaging the film.

Film presentation is very important. Poor presentation is unsettling for the audience and gives the impression of incompetence.

Figure 8.5

It may be advantageous to show a film more than once to clarify information and there is evidence which suggests that stopping films for discussion/note taking, rather than expecting students to take notes during the screening contributes to learning.

The still picture clutch or stop frame mechanism available on most film projectors is very useful if you need to stop and to analyse a particular frame at any time.

The Follow Up

The follow up activities will depend largely upon your purpose in using the film. The only thing which we are sure about is that some form of follow up activity is essential if the students are going to achieve maximum learning from a film.

One possibility is to reinforce the film with other materials, which may be in either print or non-print format.

Students do differ, and individual differences will cause the general impressions left by the film to vary. Discussions after the screening will help to clarify points of view and to develop the major ideas presented in the film. These may be facilitated by the use of questionnaires where the students fill in missing information which would have been provided by the film.

AN OPERATOR'S CHECKLIST

THE ROOM

- check that there is a properly placed screen
- check the positioning of chairs
- check position of the power point
- check that there is a projector stand
- check blackout facilities
- check facilities for emergency exit

THE EQUIPMENT

- check all connections and leads
- check that the rear arm is set for take-up
- check that the forward/reverse switch is set to forward
- check projector speed setting is correct
- check amplifier is on and exciter lamp is working
- check all sound components
- check that the projector is clean
- check reels for pinching, bending and attachment to arms
- check availability of spare lamps and fuses
- check that the projected beam hits the screen

THE FILM

- check that it is the correct film
- check that the reels are head-out
- check for obvious film damage - especially in the first three metres
- check for correct threading
- check focus, framing and sound level during screening

PREPARING MATERIAL

On the assumption that teaching staff borrow their 16 mm films rather than make them, this list of the Australian Council of Government Film Libraries is provided. The libraries will be able to provide you with information about their conditions for registration and borrowing.

CANBERRA

Film Curator
National Lending Collection
National Library of Australia
Parkes Place
Canberra ACT 2600
Phone: (06) 262 1111
Fax: (06) 262 1703

NEW SOUTH WALES

Manager
Extension Services
State Library of New South Wales
Macquarie Street
Sydney NSW 2000
Phone: (02) 230 1557
Fax: (02) 232 4816

Senior Education Officer
Film and Video Library
NSW Department of Education
Smalls Road
Private Bag 3
Ryde NSW 2112
Phone: (02) 808 9444
Fax: (02) 809 6341

NEW ZEALAND

Manager
National Film Library
National Library of New Zealand
Cubewell House
Kent Terrace
Wellington 1
New Zealand
Phone: (04) 84 9890
Fax: (04) 74 3042

NORTHERN TERRITORY

Librarian-in-Charge
Northern Territory Film Library
1st Floor
Capricornia House
21 Lindsay Street
Darwin City NT 0800

or

Po Box 39971
Winnellie NT 0821
Phone: (089) 89 5908
Fax: (089) 81 3401

QUEENSLAND

Senior Librarian
Audio Visual Services
State Library of Queensland
PO Box 488
South Brisbane QLD 4101
Phone: (7) 840 7836
Fax: (07) 846 2421

Co-ordinator
Audio Visual Services
State Library of Queensland
PO Box 488
South Brisbane QLD 4101
Phone: (07) 244 7031
Fax; (07) 229 0506

SOUTH AUSTRALIA

Director
SA Film and Video Centre
113 Tapley's Hill Road
Hendon SA 5014
Phone: (08) 268 7366
Fax: (08) 347 0385

TASMANIA

Librarian
Media Library
Education Department of Tasmania
71 Letitia Street
North Hobart TAS 7002
Phone: (002) 30 7196
Fax: (002) 31 0236

VICTORIA

Film and Acquisitions Officer
Film and Video Collection
Materials Production Curriculum Branch
Education Department
Level 1, Rialto Towers
525 Collins Street
Melbourne VIC 3002
Phone: (03) 628 2804
Fax: (03) 628 2108

Director
State Film Centre of Victoria
1 Macarthur Street
East Melbourne VIC 3002
Phone: (03) 651 1301
Fax: (03) 651 1502

WESTERN AUSTRALIA

Manager
State Film Centre
Alexander Library Building
Perth Cultural Centre
Perth WA 6000
Phone: (09) 427 3156
Fax: (09) 427 3256

ADVANTAGES AND DISADVANTAGES

ADVANTAGES

Are particularly useful in describing motion

Before the advent of video, film was the only medium with this quality, and it still excels in that it can be used to show relationships or to give impact to a topic.

Complex subjects can be presented in comprehensible units

Special photographic techniques like microphotography, telephotography, animation, slow motion photography and time lapse photography extend the limited normal range of human experience and facilitate the viewing of actions which the eye would normally be incapable of perceiving.

Film helps overcome physical boundaries

Film provides a 'front seat' for many learning experiences. Demonstrations by experts can be filmed using all of the necessary equipment, showing all essential steps, and giving explanations in ways which provide close-up views for every student.

Film can act upon two senses at a time

The fact that film has both a visual and an audio component should allow it to increase learning.

Colour fidelity is excellent

No medium can surpass film when it comes to producing images (especially large images) where colour fidelity is important.

A common standard exists

There are no compatibility problems with film. All 16 mm films can be projected on all 16 mm projectors.

Films are flexible

Films can be projected to individuals, or to large groups, and they can be projected whole or in short clips as required.

Equipment is relatively portable

It is feasible for one person to organise and carry all of the equipment required to project a film to a large audience.

DISADVANTAGES

Operation requires some skill

Special training is required to become a proficient operator, and in some states, a licence is required to operate a motion picture projector.

Films are expensive to produce

The cost of production is such that for teaching purposes it is necessary to borrow what is available from film libraries, rather than prepare films to suit a particular curriculum.

The sequence is fixed

It is not possible to rearrange the sequence of the film.

The number of available films is decreasing

The popularity of 16 mm film is decreasing as more material is being made available in the various video formats.

9. VIDEO EQUIPMENT

RECEIVERS AND MONITORS

The most basic item of video equipment is surely the television receiver. Without this we have no way of seeing the picture produced by a video camera or video recorder. It is also the item with which we are all familiar and it is tempting to suppose that there is nothing we need to learn about its use. That may be quite true in the domestic situation but if we have to use it in a classroom or lecture room, conditions may be a little more difficult.

There is only one way for the signal to get in to a television **receiver**, through the antenna socket. The sort of signal used has picture and sound modulated on high frequency carrier waves and is called a **radio frequency (RF)** signal. Different broadcast channels use different carrier frequencies. A television **monitor**, on the other hand, will accept the picture and sound signals just as they come from a video camera or video cassette recorder (called **video signal** and **audio signal**) without any high frequency carriers. If you need to, you can tell which is which by having a look round the back. The receiver has a single coaxial (circular) socket or a pair of terminals for the aerial. The monitor has additional connectors for video and audio input and possibly more for video and audio output. Often a monitor can be switched to work as a receiver, but the converse does not apply.

VIEWING CONDITIONS

The optimum viewing distance for the Australian standard 625 line picture is four times the picture height. This may be achieved quite comfortably in the lounge at home. To approximate to it in the average classroom may involve some shuffling of chairs away from the usual position.

Modern television receivers produce a very bright picture and there is no need to blackout the room as one would when projecting a film. Indeed, viewing such a picture in a darkened room is a short cut to eyestrain. However, they **are** susceptible to reflections in the screen from windows or room lights which can be very distracting. The ideal lighting conditions for watching a television receiver are that the area behind the receiver (which provides a 'border' to the picture) should have the same average brightness as the television picture; there should be no reflections in the screen of windows or room lights. This may mean that the lights in front of the receiver should be turned off, if possible.

CONTROLS

Once controls have been set there should seldom be any adjustment needed. However, there is always the possibility that some previous user has had an irresistible urge to tweak so it helps to know what each control can do for us.

The **contrast** control does just what it says. It will make the blacks blacker and the whites whiter.

On the other hand, the control often labelled **brightness** has more effect on the dark tones of the picture that the light tones. It should be adjusted so that the blacks are truly black, not a murky grey, but also so that shadow detail can be seen. The setting can be quite critical. Occasionally manufacturers attempt to give this a more helpful name such as "black" or even "picture".

The **colour** control does what it says. You can turn the colour down to zero, leaving a black and white picture, or you can turn it up so that colour values are horribly distorted. The colours we view most critically are flesh tones, so if you need to adjust the colour try and do it on a face in the picture.

If you are using a video monitor there will probably be a **switch** somewhere so that you can select monitor or receiver application. If you are switched to receiver and there is no input to the aerial socket, the screen will be covered in 'snow' and this may change in character as you switch through the various channels. If you are switched to 'monitor', there will be no snow, with or without an input, and the tuner control will have no effect. Unfortunately, there is no agreement among manufacturers as to how this switch should be labelled.

A **volume** control speaks for itself but if you have a **tone** control, make sure that it has not been adjusted to muffle the high frequencies or over-accentuate the low frequencies, which can reduce the intelligibility of the sound.

VIDEO CASSETTE FORMATS

These are some of the formats you might encounter. Although they are incompatible with each other in that each can only be played on its own type of machine, any one of them can be copied on to any other.

VHS is the most commonly used domestic format.

VHS-C uses a shorter length of tape in a smaller cassette intended for use in video camcorders. If the camera has been used at standard tape speed (SP), the VHS-C cassette can be played in any VHS machine by putting it in an adaptor which is supplied with the camera. If the tape has been recorded at the slower LP speed it can only be replayed on machines which offer this alternative speed.

VHS Stereo can be played on any VHS machines but the sound will only be heard in stereo with appropriate equipment.

VHS High-Fi Stereo can be played on any VHS machine but the sound will only be heard in stereo if a Hi-Fi stereo VCR is included in the play-back system. These machines make very good audio recorders. The sound quality is still very good at half speed and a six hour recording can be made on an E180 tape.

VHS HQ recorders have circuit modifications which are claimed to improve the apparent sharpness of the picture but there is no claim that measured resolution is any better than standard VHS. Tapes recorded on HQ machines can be played on non-HQ machines and vice versa.

Super VHS uses different recording standards to achieve better picture quality. These tapes cannot be played on a standard VHS machines.

Video 8 is another format designed to give a very compact cassette for use in camcorders. It can only be played back in a Video 8 machine and these are nearly all camcorders.

Video Hi-8 is designed (like Super VHS) to give improved picture quality. It can only be played on a Hi-8 machine.

Beta is a format used mostly in mains operated recorders rather than in portable equipment. The cassette is smaller than the VHS cassette but cannot be used in VHS equipment.

Super Beta uses the same cassette as Beta but the recording parameters are changed to give improved resolution in the picture. These tapes can be played in a standard Beta machine but will not then show the improved picture.

U-Matic uses three-quarter inch tape in a larger cassette than any of the domestic formats listed above. It has a maximum recording time of 60 minutes. A smaller version of the cassette using the same recording format but having a reduced running time is available for use in portable equipment.

VIDEO CASSETTE RECORDERS

In the last twenty years an immense development effort has been put into the technology of recording video programs on magnetic tape. One consequence of this is that there are several different formats in current use, any many others which are now obsolete. All these formats are incompatible with each other so that, in nearly all cases, a recording made in one format cannot be played on a machine designed for another. Many of these formats are summarised on page 102.

Out of this confusion has emerged the standard VHS format as a sort of de facto standard, purely through weight of numbers in use rather than any particular technical merit.

CONNECTING A VCR

If you are using a television receiver (rather than a monitor) only one link is needed from the VCR (see Figure 9.1A). A cable with coaxial connectors to suit the aerial connector on the TV set is used. The end connected to the TV uses a male connector and the end connected to the VCR uses the female version of the same type of connector. On the VCR, the socket is usually labelled RF OUT. As explained above, the TV can only accept signals on high frequency carrier waves so the VCR has a 'modulator' which provides its own carriers for picture and sound on one of the spare channels in your area. If there is no label on the equipment to tell you which this is, play a tape, set the TV/VIDEO switch on the VCR to VIDEO and try tuning the receiver to channels 0, 1, 4 or 5.

Some older television receivers do not use the round coaxial connector but a pair of terminals. These have to be connected via a little unit about the size of a matchbox called a balun.

If you have a video monitor you have the option of direct connection of picture and sound and this may offer some improvement in picture quality in some circumstances. A sound lead connects **audio out** on the VCR to **audio in** on the monitor, using phono connectors (Figure 9.1B). **Video out** on the VCR is connected to **video in** on the monitor using a cable with coaxial connectors which are not, however, the same type which are used for the aerial connection. They may be phono connectors as used for the sound signal, or they may be BNC connectors (B for bayonet) which have a push-and-turn action. Other options which may be encountered are a 21-pin SCART connector at one or both ends of the 8-pin Honda connector. Both these carry sound and picture. Finally, be sure that the monitor/receiver is switched for monitor application.

If you need a TV aerial connected to pick up broadcasts this goes to **RF in (Antenna in)** on the VCR. The signal will still find its way to the receiver and this connection avoids having to swap cables when changing from playing a video-tape to watching a broadcast.

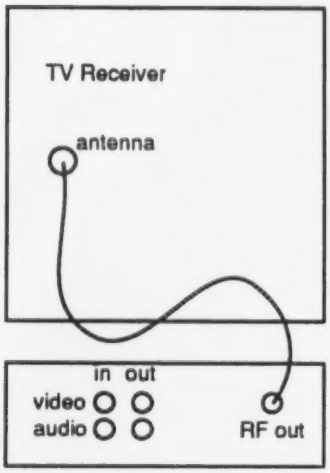


Figure 9.1A Connecting VCR and receiver

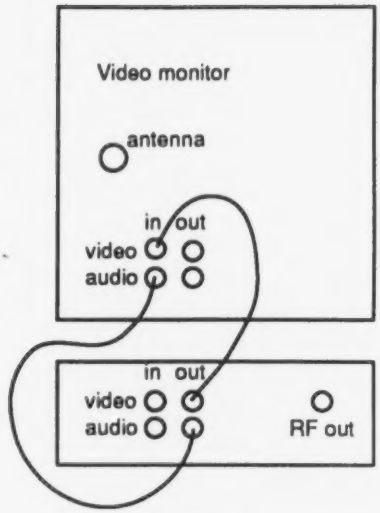
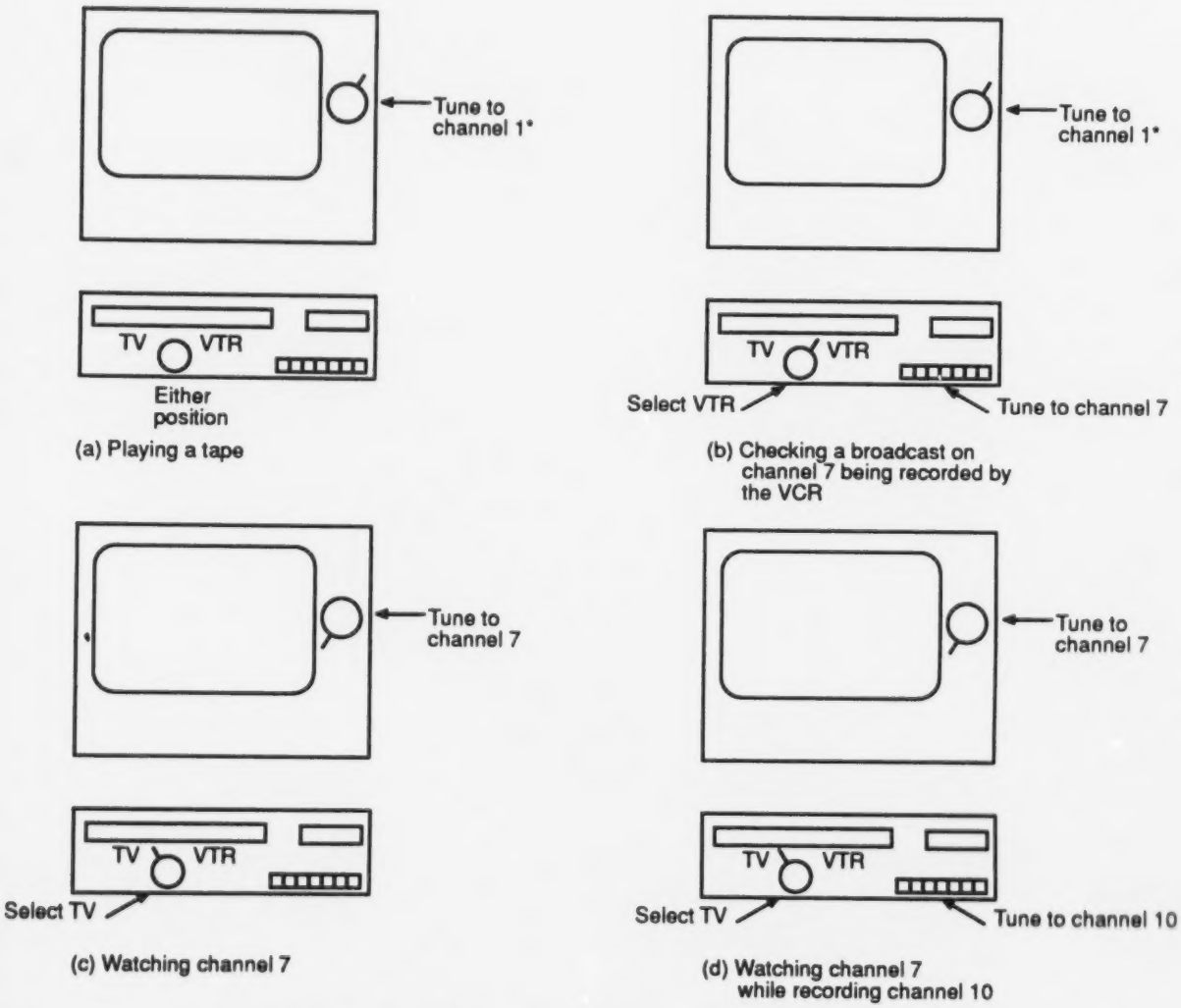


Figure 9.1B Connecting VCR and monitor

PLAYING TAPE

The video cassette recorder (VCR) must be linked to a television receiver or monitor to show a tape it is playing. The connections differ in each case, but let us assume for the moment that the connections are already made. In many cases, all that you have to do is to switch on the receiver/monitor and VCR, insert the tape (label up and in the direction of the arrow) and press the **play** button. Even the last operation is superfluous on some machines which play a tape automatically as soon as it is inserted. If you have to connect the VCR yourself, see figure 9.2.



* or whatever the output channel of the VCR is

Figure 9.2 How to set the tuners on TV receiver and VCR

CONTROLS

(Alternative names for controls are shown in brackets.)

The basic controls for tape movement are self-explanatory. The other controls on the VCR which may be involved in playing a tape are only the VTR/TV (video/TV) switch and possibly the tracking control.

As explained above, if an aerial is used, it is connected via the VCR. If you want to watch a broadcast on the receiver, using the tuner in the receiver, the VTR/TV (video/TV) switch must be set to TV. If you want to play a tape or if you want to watch a broadcast using the tuner in the VCR, set the switch to VTR (video).

The fact that the video recorder has its own tuner and can therefore operate independently of the receiver allows you to record one program while watching another. However, the presence of two tuners and the need to set the VTR/TV switch appropriately is also a potent source of confusion. In Figure 9.2 we have shown what to do in various circumstances.

Some mass-produced tapes or tapes made on a machine in poor condition may give an unstable picture when you try to play them. Try adjusting the tracking control if this is the case, but return it to its centre position when you finish playing that tape. Some VCRs have automatic tracking and you will not find a control on these.

There are many other controls on a VCR, often concealed behind a door, but they are there for setting the clock, adjusting the tuner and recording with or without the timer. If your interest is only in playing tapes you can ignore these other controls.

Figure 9.3 Protecting a VHS recording

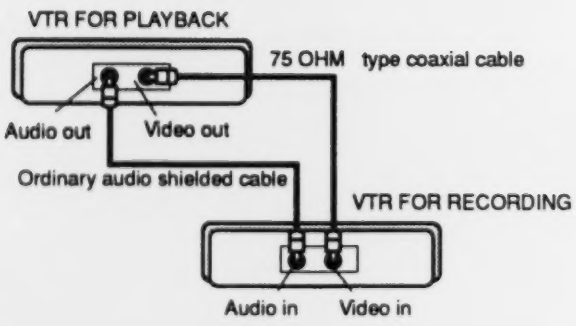


Figure 9.4 Copying videotapes

VIDEO RECORDING

Probably the most common uses for video recording are time shifting broadcasts and copying video tapes (when the copyright situation permits). Recording with a camera and editing video tape also deserve consideration.

Recording Broadcasts

Domestic VCRs, such as the VHS format, have always included a tuner and a time clock so that they can be used to record a broadcast without the need for any other equipment or the presence of an operator. Alternatively, the VCR can record one program while the receiver is used to watch another.

If you are **watching** a broadcast you have a choice, as explained above, of selecting it on the tuner in the VCR or on the tuner in the receiver. When **recording** a broadcast you **must** select it on the tuner in the VCR. As far as the recording is concerned there is no need to have the TV switched on but you may wish to use it to check what you are recording. Operate the receiver/monitor in exactly the way you would if you were watching a video-tape. Put a tape in the VCR and rewind it if necessary. Select the wanted channel on the VCR tuner. When you want to start recording, press the **record** button (and on some machines, press **play** while you hold down **record**). Look for some sign that confirms recording is taking place, e.g. an illuminated indicator. That is all there is to it as levels are set automatically for both sound and picture on the majority of video recorders.

Protecting Recordings

If recording is so simple, then so is accidentally erasing a wanted recording because a tape is erased when you press the **record** button whether or not you supply a new signal to record unless it is protected. To protect a recording, remove the plastic flap shown in Figure 9.3. When a tape of this type is loaded in the VCR the recorder cannot be put into the record mode.

Tape Duration

In many organisations it is common practice to assemble many short recordings on three hour tapes to minimise tape costs. The wanted program then has to be located by counter number or by cross referencing program duration to a chart of counter readings versus time - and then waiting for the play machine to wind to the wanted point. There is a good case for buying 30 minute and 60 minute tapes to hold single programs as they are quite cheap when bought in quantity.

Timer Recordings

Probably the VCR controls that cause most confusion, despite every effort of the manufacturers over many years, are those connected with setting the machine to record at some specified time (which can be weeks ahead on some machines). Because the procedure differs from machine to machine it is necessary to refer to the manual for the actual model you are using. If you follow the instructions carefully, step by step, there should be no problem. Don't fall into the trap of thinking that this machine will be just like some other model you have used, don't take short cuts and don't make assumptions about the procedure.

COPYING VIDEOTAPES

The connections used are shown in Figure 9.4. If you haven't seen the original tape, play part of it in case the picture is unstable, indicating that adjustment of the tracking control is needed. Some recorders rewind nearer the beginning of the tape than others and it is wise to record over a few seconds, at least, of tape before your wanted program starts. Set up the tape to be copied in the play machine and pause it just before the start of the program. Run the record machine in record mode for a few seconds and then release the pause control on the play machine.

As soon as the copy is complete, remove the protection tab and label the cassette and its box.

THE VIDEO CAMERA

A video camera used with the classroom monitor can be a powerful visual aid. Used with a recorder and a modest investment of time it can give you material which can be used many times over or, possibly at very short notice, integrated into a lecture. With rather more preparation it is possible to make complete programs which can be shown to a group or made available for individual study on demand. Much routine presentation of basic material can be avoided by doing this, freeing the lecturer to give individual help to those students who need it.

The Video Camera as a Visual Aid

Present day video cameras give a good colour picture under normal room lighting. It is seldom necessary to introduce extra lights. They can be connected to either the video input on a monitor or via a modulator to the aerial input of a receiver. A modulator is often supplied with the camera. Possibly the greatest use of camera-with-monitor in the classroom is to show an enlarged image of something which is too small for a group to see properly, even if they crowd around. This could be a sewing demonstration, or a watch repair, or the camera can be coupled to a microscope with additional fittings.

One thing which is common to all these applications is that the camera must be firmly supported, usually on a tripod. A hand-held camera has its place on the sports field but it is unlikely to give a viewable picture when used for close-ups of small objects.

The Lens

Nearly all video cameras designed for the domestic market are fitted with a zoom lens. This has adjustable magnification and makes is possible to compose the picture you want without physically moving the camera to-and-fro. It also makes it easy to put the subject in perspective by starting with a relatively wide-angle shot so that the subject can be seen in relation to its surroundings, and the zooming into the close-up you want. It is important to realise that focus is much more critical when the lens is zoomed into a close-up so always adjust focus with the lens zoomed in for a close shot. If you don't make this preparation the effect of your subsequent zoom-in will be lost as the picture goes out of focus.

Some cameras give you the option of auto-focus and this can work well most of the time. At other times it may decide to focus on something which is not your choice and you would be better off using manual focus. A very useful compromise found on many cameras is a

push-button which uses auto-focus to focus on the subject in the middle of the picture and then, when the button is released, leaves the focus set at that distance until you change it.

On many lenses the zoom can be adjusted manually or via a motor drive. The motor is not to save your wearing out a finger but to ensure a smooth zoom which is very difficult to do manually. The manual control is very useful for quick changes when composing the picture or adjusting the focus as described above. On modern cameras the lens aperture is usually adjusted automatically but manual override may be available.

Most zoom lenses have a minimum focus distance of about 1 meter and this sets a limit to how much you can enlarge a small subject. However, there is usually a 'macro' range of operation. When the manual zoom control is adjusted for this operation the normal zoom action is lost and the zoom control is instead used to focus the picture. It is now possible to focus on objects very close to the front of the lens so large magnification is possible.

Another, and possibly better, way of getting a close-up picture is to fit an accessory lens. This is a single glass element which screws on to the front of the zoom lens, like a filter, and allows the lens to focus much closer to the subject. Lenses are available with powers of +1 to +4 dioptres. The higher the power, the closer the focus. The advantage of this approach is that the lens can still be zoomed although the zoom range is limited. If you buy an accessory lens you will need to know the diameter of the screw thread at the front of your zoom lens.

Connecting the Camera

The picture connection using a video input or an RF input (via a modulator) has already been mentioned. Many cameras have a microphone permanently fitted. If the audio output from the camera is allowed to reach the loudspeaker, feedback can cause unpleasant whistles. This is easily avoided by turning down the sound on a receiver or, in the case of a monitor, just not connecting the audio.

The remaining connection is to bring power to the camera. If the camera is designed for use with a separate recorder, it draws its power from this unit so you may need the recorder to be connected even though you are not recording. The recorder in turn draws its power from batteries or from an AC adaptor. There is little point in using batteries if AC mains power is available as the battery may fail in mid-demonstration. Alternatively, you may have available an AC adaptor designed to operate the camera without a recorder in this situation.

If the camera and recorder are combined in one unit to form a 'camcorder' you have the same options of using the battery or an AC adaptor and, again, the AC adaptor would usually be preferred.

White Balance

For most of us it is a surprise to learn that 'white' comes in a range of colours. The eye adjusts incredibly quickly to a change in the colour (as well as the brightness) of the ambient light. We are hardly aware that sunlight is a different colour from room lighting at home which is different again from fluorescent lighting.

Colour film records these differences all too accurately and so it is designed and sold for a particular light source - usually daylight. If you want to use that film with different

lighting conditions the camera must be fitted with an appropriate colour filter.

Video cameras have various ways of coping with the problem. Some very early cameras used the colour filter approach but it is unlikely that you will meet one of these. A much better arrangement is a semi-automatic adjustment in which the camera is first pointed at a white subject and then a button is pressed which, in effect, tells the camera it is looking at white and the camera adjusts itself so that a neutral white is reproduced for that subject. This is a very flexible system and allows the camera to make accurate corrections for any likely light source. The only disadvantage is that the adjustment will have to be done afresh each time the camera is switched on. As the subject does not have to be in focus when the adjustment is made, it is a good idea to carry a white card which can be held in front of the lens for the few seconds it takes for the adjustment to be completed. Just make sure that a reasonable amount of light is reaching the card.

Another approach which is increasingly found is a fully automatic system. Here the camera uses the average colour of the scene to set white balance. This requires no action on the part of the user, but like most automatic operations, it can be fooled into giving you an answer which is not the best under some conditions.

Camera Recordings

The actual operation of the recorder is usually the least of any problems which might arise. Camera-recorder combinations differ in detail but if the camera is already connected to the recorder, as described above, all that remains is to put a tape in the recorder (having checked that the protection tab has not been removed), check that it is rewound and put the camera in the record mode. Compose and focus the picture you want and press the trigger on the camera. There is usually some indication in the viewfinder that recording is taking place. When you have finished that shot, press the trigger again and the tape will be paused in the record mode.

If your next shot is ready within a few minutes you have only to press the trigger again to commit it to tape. If the delay is longer than this, the recorder will automatically revert to the stop mode to avoid damage to the tape or recording heads. When you are ready to record, playback the tape to the point where you want the previous shot to finish (but don't go beyond it into blank tape). Pause the tape, change the recorder to record mode and proceed as before.

Recording Indoors

Most subjects can be recorded satisfactorily with the existing light levels and this avoids the hassles that go with extra lighting. The floodlights sometimes used for photography are often much too powerful for the video camera and give over-contrasty pictures with harsh shadows. If the existing lighting is unsatisfactory it is likely to be a matter of direction and diffusion rather than quantity.

Windows can be a problem if it is daylight outside. If the window falls within the view of the camera, the automatic exposure circuit in the camera will reduce the sensitivity so that anything inside is reduced to shadows and silhouettes. The solution is to place the camera with its back to the window so that you use the light to illuminate the subject, not to dazzle the camera.

If possible, arrange your subject matter so that the background is not distracting.

Anything which competes with your intended subject will reduce the effectiveness of your communication.

In your concern for good picture recording, do not overlook the sound. The microphone fitted to the camera is effective if reasonably close to the subject but if you use the zoom lens to get a close-up, the microphone cannot zoom with it and the sound pick-up may be unsatisfactory. This is particularly likely in a room with little sound damping. The alternatives are to get the camera closer, if this is possible, or to use a separate microphone nearer to the subject. Nearly all cameras or recorders have a socket for external microphone which automatically disconnects the camera microphone.

Recording Outside

First things first: if your camera is one of the older designs which does not use a solid state pick-up ('CCD') **you must be very careful that it is not allowed to look at the sun.** If it does, it may be permanently damaged. Keep the lens cap on at all times when the camera is not in use. (This is also sound advice for any video camera in any situation, but less imperative.)

You will almost certainly be using battery operation so you will need to be sure that the battery is fully charged before you start. How long a fully charged battery will operate the equipment depends on many factors but is unlikely to be much over one hour. Of course, you may have a spare battery which will double your recording time. If you want to maximise recording time, don't use the zoom motor unless recording, don't playback the tape unnecessarily and switch off the camera while you are thinking what to record (even though you may then have to check the white balance again). Recharging the battery can take about three hours.

If your subject matter is confined to a limited area you might find if very helpful to mount the camera on a tripod. Not only will this relieve the strain on the wrist but it will give you much steadier pictures than are possible with a hand-held camera. Either way, try not to use the zoom lens at the telephoto (maximum magnification) end of its range. This not only magnifies the subject but equally magnifies any small movements of the camera. Don't be influenced by pictures of glamorous models holding a tiny video camera in one hand. Your pleasure in looking at the model is unlikely to be matched by any pleasure in looking at the wobbly pictures when the tape is replayed.

For semi-mobile use a 'monopod' as a useful compromise. It has a single leg and steadies the camera in one direction; not as steady as a tripod but much more portable.

Camera 'Movements'

The word is in quotes because we want to include consideration of the zoom with movements such as the 'pan' (sideways movements) and 'tilt' (up and down movement).

Every camera movement should have a clear motivation. The best motivation is panning the camera to keep a moving subject in view. Ideally it is only the background which is seen to move as the subject stays in the same relationship to the frame of the picture. Another good motivation is zooming in to see something of real interest more clearly. But this must be done with restraint. Too much zooming soon becomes vertiginous for the viewer and a good operator doesn't do it. Use manual zoom to compose a shot but always use the zoom motor when recording for smooth control.

Having zoomed in, don't be tempted to pan unless to keep your subject in view. Panning over static subject matter is to be avoided at any time, but doing it in close-up is really painful. The alternatives are to zoom out before you look for your next subject or - better - stop that shot when you have enough of the close-up and compose your next shot while the tape is paused.

'Compose' is a key word here. We are accustomed to thinking of composition being important in relation to a painting or a good photograph. It is equally important to a good video recording. This is not the place to re-run the rules of composition, but if you haven't ever thought about it and want to give your video recordings a professional touch, find a book on photography that suits you (there are hundreds to choose from) and have a look at the chapter on composition.

Camera movements have their place, but that place is not at the beginning or end of a shot. In other words, never start or finish a shot while the camera is panning, tilting or zooming. Start with the camera at rest on a well-composed picture, move it if you need to but finish with the camera still before you press the trigger to terminate the shot. An exception to this general rule is obviously when your subject is already on the move and you have to move with it. But don't think that you have to stay with it for ever. At some point let the subject move out of the frame and then finish the shot. This is more satisfactory than cutting the shot with the subject still (just) in view.

MAKING VIDEO PROGRAMS

The distinction between a 'recording' and a 'program' largely depends on the care that is given to the detailed preparation of a program. For example, setting up a camera at the back of a lecture room and recording a standard lecture which makes no concessions to the needs of the camera will give you a recording, not a program. With luck, the recording might have some value (if only to the lecturer). Almost certainly, a carefully planned program on the same topic will be much more effective in putting over your message, but it will need a greater investment of time.

The Concept

It all begins when someone sees a need for a program on a particular topic and has some ideas on how that need might be met. There is often scope for a fruitful collaboration between a subject specialist and someone with experience in program making.

Who Will See It?

Before the fine detail of the content can be decided you will have to have a clear idea of the people for whom the program is being made. How old are they? What do they know already? Will the program be seen by individuals, by groups or by both? Do you want specific feedback during the program or at the end?

Content

When these points have been decided it is possible to set out a logical sequence of the material to be covered. The next stage is to plan the program shot by shot. This could take the form of a script, a story board or just a shot list. A script usually has at least three columns (Figure 9.5). The first gives the shot number, the second indicates the picture content, (e.g. close-up of test tube) and the third gives the sound content, whether

voice, music, ambient sound or whatever.

12	c v 3.5 mm jack zoom out to show other jacks	Another common audio connector is the jack. The inner wire of the cable is connected to the tip and the cable screen is connected to the sleeve. The jack comes in three sizes. This is the 3.5 mm jack which is a scaled down version of the original telephone jack commonly known as a ¼ inch or 6 mm jack. There is also a smaller version called a 2.5 mm jack. Any of these connectors completes a single circuit, say an audio input or output. Sometimes multipin connectors are used with two or more cables attached.
13	remove DIN plug and turn it to camera	The most common multiplin audio connector is the 5-pin DIN plug, but it is also found with 2, 3, 4, or 6 pins. There is also a second 5-pin type in which the pins are more widely spaced.
14	insert phono plug	Now the single circuit connectors such as the phono or jack plug can be inserted without worrying about the orientation but with the DIN connector you have to look for the groove or other indication on the body of the plug and line it up with the socket. Earlier we mentioned the range of frequencies found in the audio signal.
15	O H P caption frequency scale. animate zoom out to show video scale. animate	extending from about 50 Hz to 10 KHz. When we look at the range of frequencies in the video signal produced by the scanning process we find that they extend up to several **million** Hz, or mega Hz for short. This affects the sort of cables and connectors used for the picture signal.
16	Coax cable	The cable is like an enlarged version of the screened audio cable. To reduce losses of the high frequency signal the inner conductor is covered with a thick layer of low loss plastic, such as polythene and this makes video cable much less flexible than audio cable.

Figure 9.5 Script for video program

A storyboard gives a simple sketch of the intended content of each shot and shows more clearly what is included (or excluded), as well as the shot numbers and sound content. It is probably the best option if several people are involved in the planning stage.

A shot list contains the least information but is the quickest to produce. Which type of plan you choose depends to some extent on the nature of the program but to a large extent on your personal preferences.

Starting the Program

Shot 1 in your script should always be a few seconds of black (recording with the camera lens capped) with silence on the sound track. This gives recorder and monitor a chance to stabilise before the program starts and avoids the snow and hiss of blank tape.

Shot 2 should be a title and ways of achieving this are discussed below.

Shot 3 begins the program proper and is usually an 'establishing shot' which sets the scene and puts things into perspective before any close-ups are used.

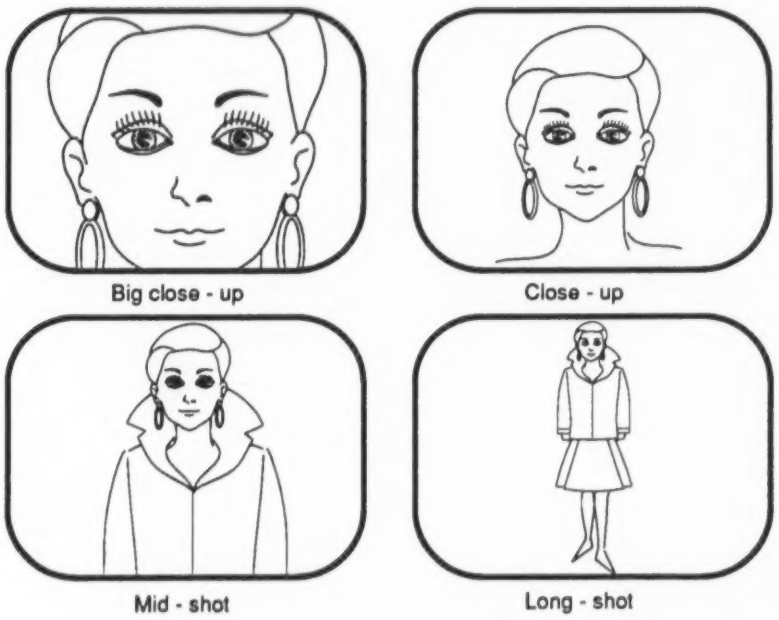


Figure 9.6 Production terminology

Vary the Picture

A program which consists of a few very extended shots can be visually boring. When planning the sequence give careful thought to possible changes to the viewpoint which will help to maintain interest. This is the sort of terminology which helps you to record or convey your intentions (Figure 9.6).

A long shot (LS) is a wide angle and would show a person full length.

A mid shot (or medium shot, MS) is a medium angle view and would show a person from waist up.

A close up (CU) is a head and shoulder picture. A big close-up (BCU) gets as close as possible and, for a person, would show part of the face from mid-forehead to the chin.

When changing from one to another with a single camera you have the choice of zooming in or out, or stopping the recording while you set up the next shot. If you zoom it is not necessary to move the camera but too many zooms can be disturbing. If you stop and restart with a different zoom setting, the angle of view should be changed (i.e. move the camera sideways) or you will see a 'jump cut' when the tape is replayed, when the camera appears to jump forwards or backwards. But don't go to the extreme of taking successive shots from opposite sides of the subject or your viewers will have a difficult task of re-orientation.

If your program is all about how to do something (e.g. welding or cake icing) try to give the camera the operator's view, as far as possible, not the spectator's view.

Finishing the Program

An ill-planned program doesn't finish, it just stops, deserting the viewer. If your conclusion is well-planned, picture and sound will convey finality with no need to put 'The End' on the screen. Appropriate concluding words on the sound track, maybe a credit or acknowledgment on the screen, the end of the opening music, all contribute to giving a professional polish to your program.

Titles and Graphics

The simplest approach to preparing a title or graphic, although not necessarily the quickest, is to write or draw it on convenient sized card. A light tone on a darker background looks best but is not the easiest of produce. Excellent results can be obtained using transfer lettering (such as Letraset). A limited number of typefaces are available in white. Choose one which is simple and bold; Universal and Helvetica are good examples. Don't feel tied to uppercase lettering just because it is a title. A mixture of uppercase initials and lowercase text often looks well and reads more easily. When cutting the card for your artwork remember that the proportions of the television screen are four units wide by three high and your card must have the same proportions.

Another thing to bear in mind is that on a television receiver the edge of the picture is masked off but how much is lost is somewhat variable. Leave a margin all round your graphic of at least 10% of the width of the card.

Help from the Camera

Recent designs offer a variety of aids to graphic preparation. Many cameras have built-in character generators and can store one or more 'pages'. Disadvantages may be that selecting the characters can be a tedious process, you may be limited to uppercase letters, the shapes may be rather jagged and there will be some limitation on exactly where on the screen you can put the letters. On the other hand you can usually choose the colour of the lettering (and possibly the background) and you can superimpose the lettering over whatever picture the camera is focused on.

Some cameras have a POS/NEG control which allows you to draw the caption in black and white (which is usually easier) and then convert it electronically to the preferred white on black.

Another possibility is that an image can be stored (such as a shot of your caption) which can then be reproduced on demand or superimposed over another picture. For superimposition to be effective, it is essential that the caption should be light on dark and safest if you start with white on black.

Recording Program Sound

The 'audio dub' facility on portable recorders (and on some mains models) can give you a choice of sound recording techniques. You can record the sound with the picture or you can first concentrate on getting the picture right and then use audio dub to add the sound afterwards.

Of course, the choice is not always there. If you are recording a 'talking head' it must be done simultaneously and the same applies if the sound is an important element of the process being viewed. But if the sound is essentially a commentary on what we see in the picture, it can reduce the stress level during production to add sound after the picture has been recorded. A detailed script is fairly essential here to make sure the shot is long enough to accommodate what you want to say.

Script Writing

Although the best programs are often made from a complete script in which every word has been written out, they don't **sound** like it. The script writer has to acquire the art of writing spoken language, not written language. For example, scripts have sometimes been produced in abbreviations: 'Turn screw B to left. Adjust until meter M reads 5.6. Clamp screw G' and so on, straight out of the instruction manual. The sound should amplify and reinforce what the picture shows. There is no need to say what we can see for ourselves. It would be better to write, 'As this screw is turned to the left you can see the meter needle is moving. We set it to 5.6. Now we tighten this clamp to stop it drifting'.

You may find it helpful to first extemporise what you want to say onto an audio cassette. As you transcribe this onto your script, hesitations are eliminated, repetitions removed and infelicitous expressions revised- but still with the flavour of spoken language.

Microphones

Because every camera comes with a built-in microphone and it can be relied on to pick up something, there is sometimes a tendency to accept it as the best that can be done. However, most cameras or portable recorders also have provision for connecting an alternative microphone and this is often worth while. For example, if you are recording a lecture with an audience present, the camera is usually situated back in the room among the audience. Its microphone is well placed to pick up the coughs and *sotto voce* comments of the listeners, less favourably placed for recording the lecturer. A microphone placed near the lecturer would correct this unbalance. If an external microphone is connected, the internal microphone is automatically disconnected.

There is a basic choice to be made between non-directional and directional microphones. As the names imply, the former is sensitive to sounds from all directions. The latter has a sensitivity which varies from a maximum to sounds in front of the microphone to a minimum to sounds from behind the microphone. In our lecture example, a directional (or 'cardioid') microphone near the lecturer would give excellent recording quality provided the lecturer did not move around. It might give very little pick-up of questions or contributions from the audience.

Although it is not necessary for the microphone to be concealed in this and many other applications, it is desirable that it should not be visually obtrusive. There are two types which are particularly worth noting with this in mind. One is the 'tie clip' microphone which is very small and can be simply clipped to the clothing of the speaker. Although it is omnidirectional, its proximity to the speaker means that it does not pick up much sound from other sources. It might not be very effective, for example, in picking up questions from the audience. Another useful type is the PZM omnidirectional. This has a very flat profile, unlike other microphones, and is placed on the floor or a table. It is effective in picking up sounds from all directions without the cavernous quality sometimes found with conventional microphones.

EDITING VIDEO TAPE

Most video recordings will benefit from editing. This may be only a matter of shortening some shots where the point can be made more concisely than in the original, or it may be major surgery to eliminate disasters.

Assemble Editing

The best place to edit is in the camera and the time to do it is when the original shots are recorded. If you can achieve this, your master tape is a 'first generation' recording and avoids the loss in quality that inevitably results when a domestic format tape is copied. In this case the shots are recorded in the final order and, when complete, of exactly the right duration to accommodate the sound as well as the picture. This is called 'assemble editing'.

If the shots are recorded as previously described there will be no disturbance of the picture as the new shot commences. Each shot should originally be a few seconds longer than the intended length as the next shot can be started at any point in the previous recording and will automatically erase the unwanted remainder of the old recording.

Note that when you release the pause button to start recording the next shot there is a delay of about one second before recording starts and you may want to cue your talent accordingly.

Checking Record Delay

Unfortunately, most cameras do not give a visual indication of the precise moment at which recording starts. One second is long enough to be significant in a carefully timed shot and it is worth taking the trouble to do a simple experiment with your recorder to see what the delay actually is. To do this, set up your camera to show a close-up of a clock or watch face with a sweep seconds hand so that you can read the divisions clearly. Put a tape with an expendable recording in the recorder and pause the tape at any convenient point. Change to the pause-record mode and release the pause button as the seconds

hand passes '12'. When you replay the tape you will see the time delay before recording actually started and you will know exactly how long to allow for that recorder on each shot.

There is usually no delay when audio dubbing and the machine can be used like an audio tape recorder. Instead of using the RECORD button, use AUDIO DUB.

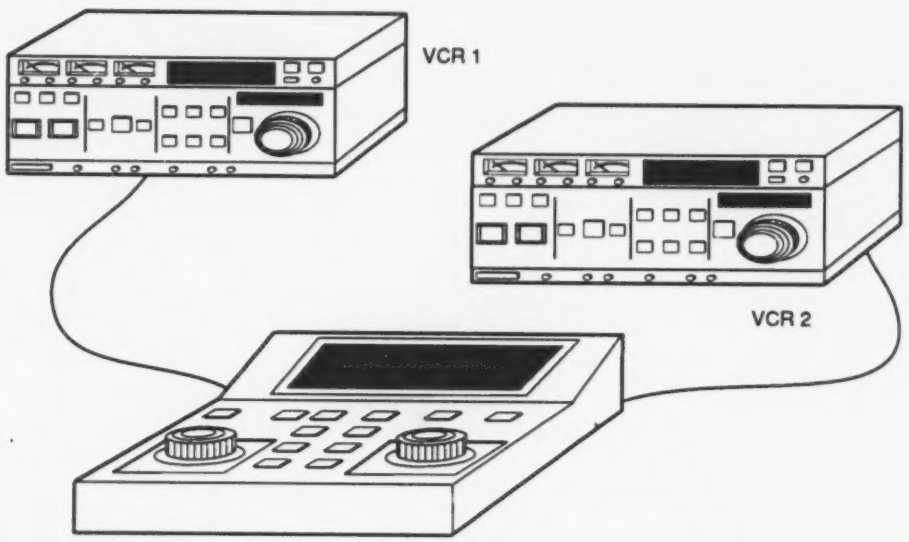


Figure 9.7 Video editing suite

Insert Editing

Many portable recorders and a few mains models permit insert editing. In this case a new recording replaces a section of an original recording. If you try to do this with the normal record controls, your new recording will always be followed by a few seconds of erased tape, i.e. you will lose some of the next shot. The insert edit control overcomes this problem and gives a clean start and finish to the new section. Note that it always replaces the equivalent duration of the original recording; if your insert lasts 10 seconds, you lose 10 seconds of the original. Many machines, when insert editing, record over the old material without first erasing it and the picture quality may be slightly inferior to assemble edits. However, it can be very useful, for example for adding short close-ups of a procedure without interrupting the original recording. Other machines have a 'flying erase head' and with these an insert is as good as the original recording.

On most recorders, insert edit leaves the original sound unchanged. However, if you wish to change the sound as well, audio dub can be used as a separate operation. On a few machines, insert edit replaces the original sound as well as the picture, without the option.

Unfortunately, you cannot insert edit over blank tape as it is necessary for there to be a continuous control track. If you accidentally erase some of your original you cannot patch it up with an insert edit. The only options open to you are either to remake the program from the shot before the blank tape to the end, or to copy the tape in two sections, doing an assemble edit to avoid the erased tape.

Tape to Tape Editing Using Two Video Recorders

You have much more flexibility in editing if you accept that your master tape will be second generation. Now you can record the shots in any order you like, on different tapes if need be, with no need for great precision in the timing of the starts or finishes. The timing is done when you edit. But you must either ensure that your original shots were 'assemble edited', i.e. have no unrecorded gaps between, or allow five seconds at the beginning of each shot before the wanted material begins to allow time for the editing machines to synchronise.

We have already described the way to connect two video recorders for tape copying. The play machine should be a camcorder. Tape-to-tape editing is essentially the same process but be warned that it is difficult to edit with precision using this technique. If your sound is already recorded, trying to cut accurately from the end of one sentence to the beginning of another will need practice to allow for the time delay before recording starts and the possible loss of material at the end of the previous shot.

The Editing Suite

Difficulties of editing are swept away if you can get access to an editing suite (Figure 9.7). This consists of two special purpose VCRs linked by a control panel. One VCR plays the original recordings, the other records the master tape. Both have 'jog shuttle' controls which allow you to move the tape in either direction at a speed which can be varied between seconds per frame to many times normal tape speed. When the chosen edit points have been selected on each tape the edit can be previewed at the touch of a button. This shows you what the edit will look (and sound) like without actually recording it. If you don't like it, readjust the edit points and try again. If that satisfies you, press another button and the recording is made automatically within the selected edit, accurate to about one twentieth of a second. Edits can be assemble or insert, and insert edits can be picture or sound or both.

10. COMPUTERS

INTRODUCTION

You have probably heard of Apple, Atari, BBC, Commodore, Amstrad, Sanyo, NEC, Sharp, Prime, Osborne, Toshiba *et cetera*. They are all computers, most of them are 'micros'.

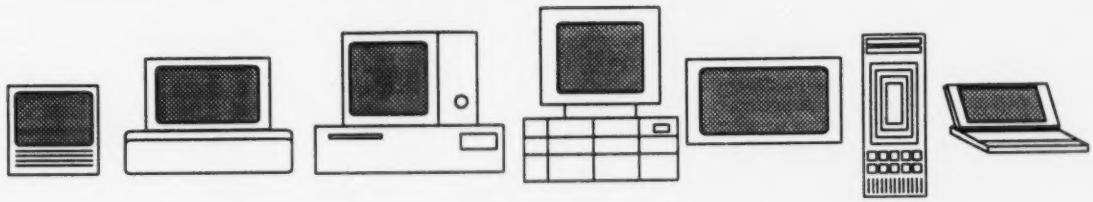
Today's microcomputers are basically cheaper, and smaller, versions of the large 'mainframe' computers which control a lot of our lives, and finances. They are different in two respects, micros have a limited amount of 'memory' and they're a lot cheaper.

'Memory' stores electronic signals that represent numbers. Some of the numbers are instructions, they tell the computer what to do with other numbers. These numbers are processed by the computer at the rate of many thousands of operations per second, taking information in and transforming it in ways that we would find boring, tedious, or impossible.

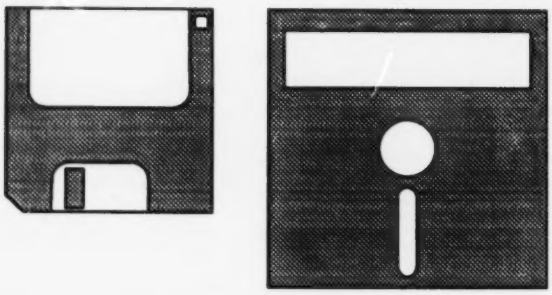
Memory is measured in Random Access Memory (RAM), a set of storage locations which can be accessed directly as soon as the computer is turned on. Early computers (such as the BBC) had very little RAM, 16-32 kilobytes or thousand bits of memory, which allowed the user to work with very simple graphics or word processing programs. Today's computers need more and more RAM for complex colour graphics, sounds and animation, and 4-8 megabytes of RAM are considered as minimal. File storage used to be on 400k floppy disks. PCs now have 20, 40, 80 or 160 megabyte hard disks, and storage devices include 45 megabyte cartridges and 600 megabyte erasable CD.ROM disks (compact disk based storage).

A microcomputer produces images by illuminating one (or several) dots at any of a number of positions on a screen. The dots are arranged in rows across and down the screen. The number of dots on the screen are not the same for every microcomputer, a typical resolution grid would consist of 192 rows, each containing 256 dots, a total of 49,152 dots. The higher the number of dots the better the 'resolution', and the less grainy the image. As a rough guide 150 x 100 points on the screen would be considered low resolution, while 1200 x 450 would be considered high.

When IBM coined the term 'word processing' in 1964 to announce a new typewriter that could record words (and to a limited extent, revise them) on magnetic tape it was at the very dawn of creation for PCs (personal computers). A modern word processing program can utilise large bodies of text, change the form and content of documents instantly, and format the text with all sorts of design capabilities, including different fonts (or typefaces), a variety of sizes and formats. The programs have the ability to move, copy, delete, search through, reformat, display and print out words in a text.



For the computer layperson, or Troglodyte, there seems to be a bewildering range of PCs available, all claiming to do everything that the new owner wishes, from horoscopes to making coffee, indeed, MicroSoft have included a coffee mug as their latest software marketing ploy!



Let's start with basics. These are floppy disks (3.5" and 5.25"), and they are used for portable storage, for distributing software, etc. They can contain from 400k to 1420k of memory, and are regarded as 'soft' media, in contrast to the 'hard disks' which are now part of most computer systems. 'Hard disks' are literally that, specially treated metal disks on which data is stored.

Figure 10.1 Floppy disks

The computer itself is made up of 4 components, the CPU (or central processing unit) which is the engine; the VDU (visual display unit) which is the screen; the keyboard, and a standard feature with most machines is the ubiquitous 'mouse'.

The 'mouse' contains a small rubber ball which comes into contact with electrical connections as it is glided across the work area. This is then transmitted to the screen, so that various on-screen elements can be selected, shifted or deleted at will.

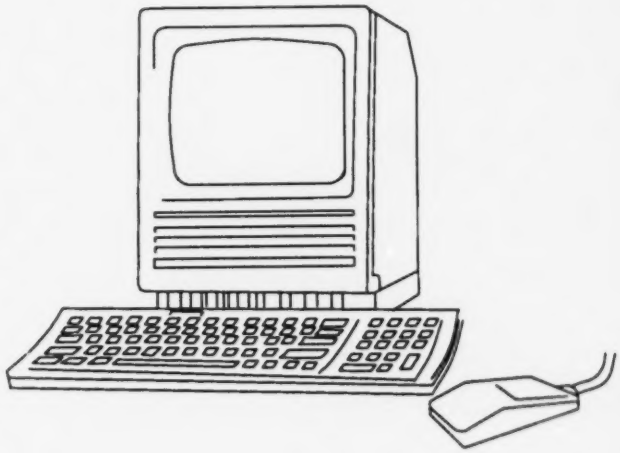


Figure 10.2 Components of a computer

If the CPU is the engine, then a software program is the 'brain'. What is software? It's a list of instructions that you give the computer to perform certain actions, written into a program. Software, as opposed to 'hardware' (the computers themselves) refers to all the

programs that will run on a particular computer. For the most part, software isn't interchangable between computer systems, so when you use a computer, you shouldn't just look at the price but at the range of software available.

Figure 10.3 Mouse

A computer is dumb but versatile. It can assume many roles, and software helps to focus its skills. The guiding force behind every computer is the user. The range of tasks that a computer performs can range from simple word processing to nuclear physics, and many more items in between. For lecturers, and students, the computer can be a dynamic and exciting aid to teaching and learning.

TAFE uses a vast range of computer equipment, ranging from simple calculators to mainframe computers for administration and enrolments. The ubiquitous PC (Personal Computer) should soon land on (or near) every lecturer's desk.

The use of computers is as wide-ranging as the number of subjects offered by TAFE colleges. Computers have an application for almost every discipline, and are being used increasingly as a very valuable teaching medium. The advent of desktop publishing has meant that many teaching materials (including this publication) are now produced on computer.

The following overview looks at the number of uses that one type of computer can be put to throughout the TAFE Curriculum area. That computer is the Apple Macintosh.

The Desktop Publishing revolution began with the concurrence of three major events in 1984 - Steve Jobs and his development team at Apple produced the Apple Macintosh; John Warnock developed the PostScript language and a range of computer fonts; and Paul Brainerd of Aldus Corporation introduced PageMaker software. This democratised the typesetting and design process - anyone with access to a Macintosh and Laserwriter could produce near-typeset quality material for a fraction of the cost of traditional typesetting. Good typographic and educational design were not necessarily enhanced by this freedom, but that's another story.

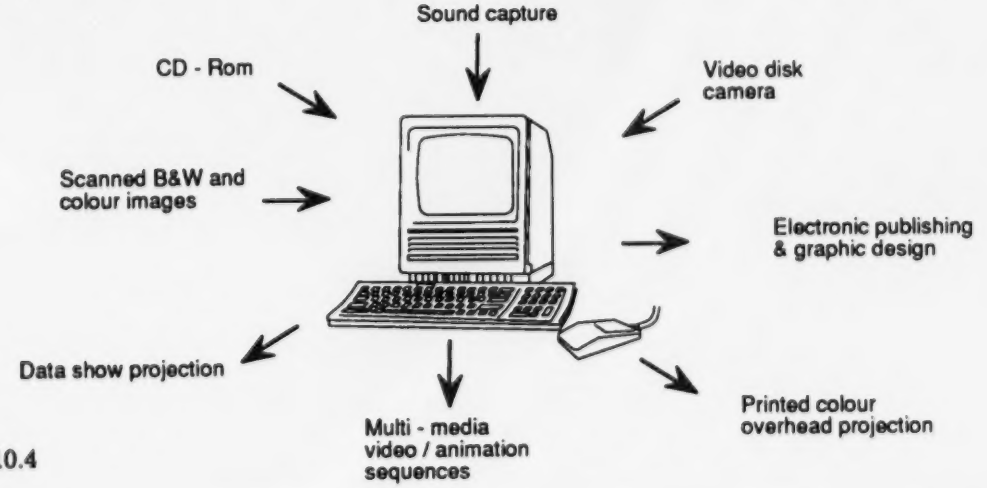

Sound capture
CD - Rom
Video disk camera
Scanned B&W and colour images
Electronic publishing & graphic design
Data show projection
Printed colour overhead projection
Multi - media video / animation sequences

Figure 10.4

The new revolution includes exciting new areas of Multi-Media course production using Macintosh and IBM computers to produce Computer Based Learning (CBL) materials. Known as Desktop Video Production, it had developed from the Hypercard concept, introduced by Apple in 1988.

The basis of the popularity of the Macintosh is its user-friendliness, and the Hypercard product was designed to take advantage of growth in other areas of technology. A graphics based environment which can be totally controlled by the mouse, HyperCard uses the analogy of a stack of related cards which make up a program. The stacks can be related to other stacks, can be navigated through in a variety of ways by a variety of users, and can interface to devices such as Videodisk, VCRs and CD-ROM. This integration of sound, graphics and full colour sequences via the Hypercard 'front-end' meant that the concept of the intuitive human interface between computer and student had become a reality.

Since 1988, many thousands of programs have been produced on Hypercard in a daunting number of educational disciplines. Everything from Astronomy to Zoology has been covered by Hypercard 'Stacks', which have mainly been produced by the specialists who needed them for their own teaching areas. The following abbreviated listing of some stacks give an idea of the range of material produced over the last three years.

ASTRONOMY - Heavenly Macintosh

A computer 'textbook' illustrates the history of astronomy from ancient times to Newton. The stack includes illustrations, text, and working models of celestial motion theories written in Pascal.

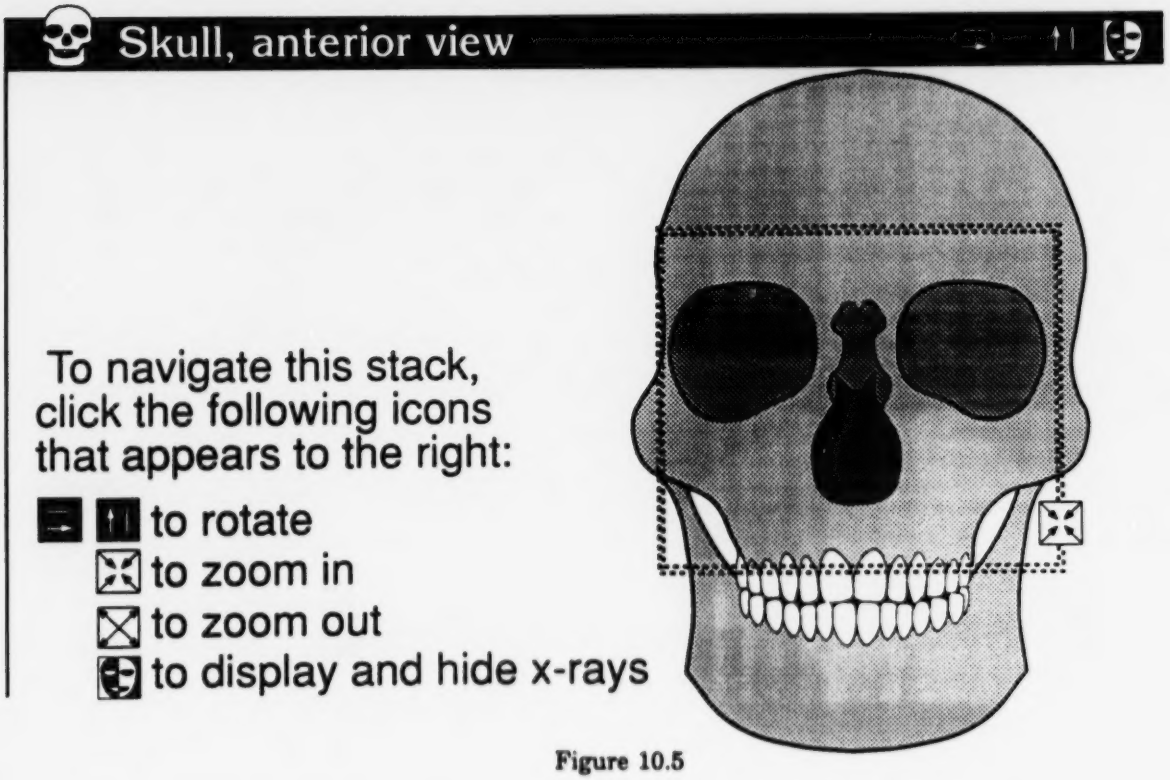


Figure 10.5

BIOLOGY

Molecular Genetics

This HyperCard project was developed for use in a course called Techniques of Molecular Genetics. The course involves about 30-40 hours of lecture and a seven-week complex lab utilising recombinant DNA theory. There is a need to describe some rather sophisticated systems and experimental approaches, which of necessity involves the use of jargon. The set of linked HyperCard stacks is designed to address the need to convey complicated and specialised information in an intelligible way.

CHEMISTRY

Chemistry Stacks

This HyperCard project consists of two interrelated stacks:

(1) a research tree with leaves consisting of summaries of each project completed, in progress, and planned; and
(2) a literature database, to be generated from the current mainframe database, which will be linked to the research tree. The project summaries includes graphics such as molecular models and spectra, and identification numbers of literary references for linking to the literature stack and for retrieval of reprints from hard-copy files.

CLASSICS

The UCLA Greek & Roman Sculpture Videodisc

Voyager's 'Videostack' videodisk driver is used with HyperCard to provide textual and bibliographical information on a videodisc with 6,000 black-and-white photographs of Greek and Roman sculpture in the major USA and European collections.

Guernica

A HyperCard/SuperCard stack which looks in close detail to the images and background of Picasso's most famous painting, Guernica. The stack allows the student to view sections of the painting in full colour, and to link graphic symbolism with background writings of Picasso and his contemporaries.

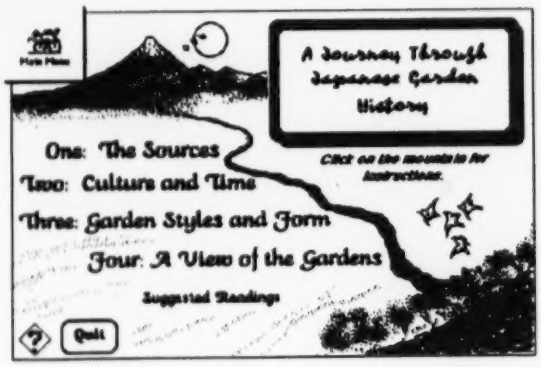


Figure 10.6

LANGUAGES

Japanese Verbs

This stack is a drill intended to help Japanese language students master verb conjugation skills. It assumes that the user has had at least two to three months of formal instruction, but enthusiastic novices would also benefit from it. Other stacks in the 'Nihongo Rabo' series include drill stacks on Japanese participles, adjectives and vocabulary. Japanese hypertext documents are being prepared for advanced students that include sound and graphics - the 'selected reading' stacks.

MEDICAL

Images of Tumours

This is a HyperCard stack entitled 'All the World's a Stage', which has drawn images of almost all types of tumours at different stages of development. Each card gives a brief description of each stage of the tumour, together with suggested treatments for the various carcinomas.

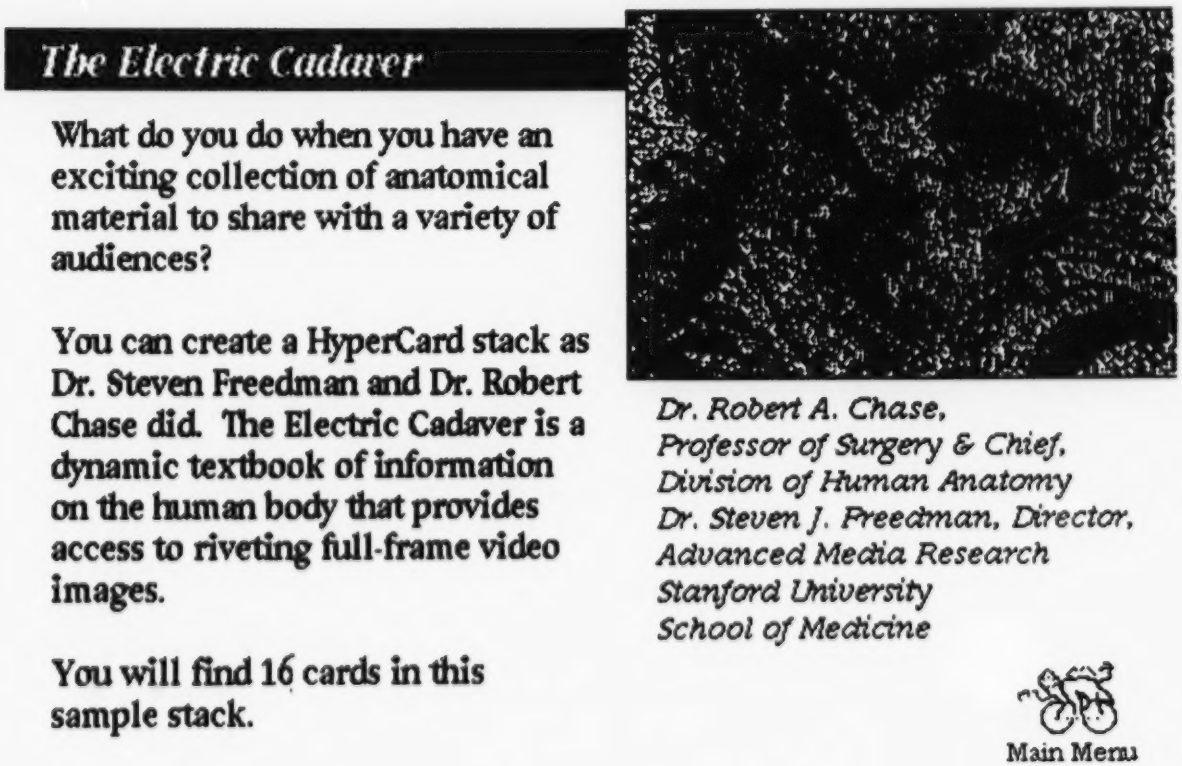

The Electric Cadaver
What do you do when you have an exciting collection of anatomical material to share with a variety of audiences?
You can create a HyperCard stack as Dr. Steven Freedman and Dr. Robert Chase did. The Electric Cadaver is a dynamic textbook of information on the human body that provides access to riveting full-frame video images.
You will find 16 cards in this sample stack.
Dr. Robert A. Chase,
Professor of Surgery & Chief,
Division of Human Anatomy
Dr. Steven J. Freedman, Director,
Advanced Media Research
Stanford University
School of Medicine
Main Menu

Figure 10.7

BEST COPY AVAILABLE

SOCIOLOGY

The Social Bond

The course Sociology 180 is concerned with the problem of social order and cohesion, as treated in the works of major social thinkers from antiquity to the early 20th century. The course is divided into four periods (ancient and medieval, early modern, modern and contemporary). There will be an 'Electronic Notebook' for each of the writers studied, using a HyperCard stack which will contain sections with the biographies of the individual writers, their social and intellectual contexts, brief descriptions of major works and important ideas, quotations, glossaries, graphics and commentaries.

ZOOLOGY

Metazoa

Metazoa contains information about the nervous, circulatory, and muscular effects of the metazoan systems.

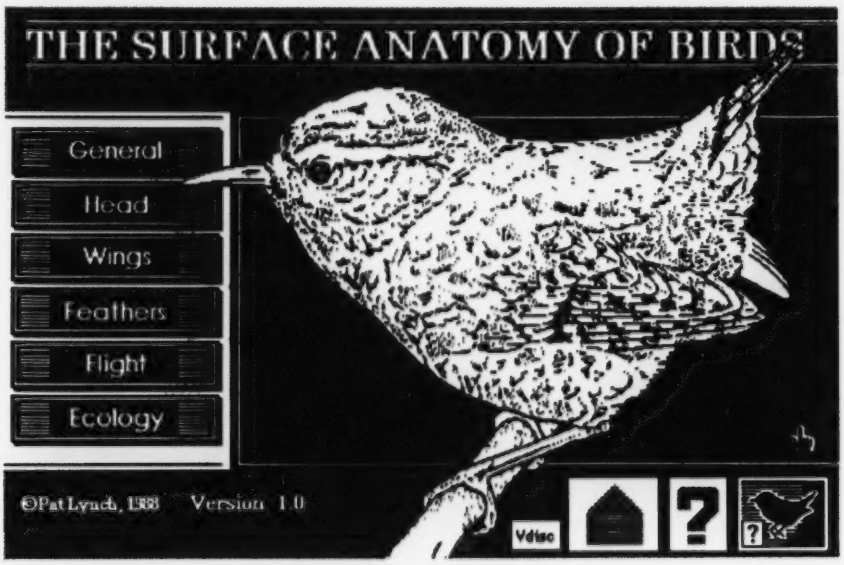


Figure 10.8

As the short samples of titles shown above confirm, the range of HyperCard materials is limited only by one's imagination.

Other packages allow total flexibility for lecturers who wish to use simulation for themselves or for students. The package that fits this bill is Extend™.

WHO NEEDS IT?

Simulation is emerging as a general purpose planning and problem-solving tool for a wide range of professions. Just as word processors and spreadsheets have become indispensable tools, simulation software is changing the way people work. In electronics,

manufacturing, architecture, business, investing, medicine, economics, aerospace, chemistry, ecology, and many other areas, simulation is saving time and money. And producing better and faster results.

WHAT'S THE ADVANTAGE?

Extend™ puts the power of mainframe simulations on the Mac Plus, SE, and II at a fraction of the cost. With Extend™ you can accurately model real world events under different circumstances. Comparing various 'what if' scenarios on the computer, you can quickly identify an optimal strategy. Correcting costly errors on the drawing board is much cheaper than discovering them in physical trials, production, or in actual use.

You can validate a theory, experiment with hazardous situations at no cost, or find a best performance/cost scenario. And now Extend™, the most powerful simulation software for the Macintosh, makes professional simulation accessible, easy to use, and affordable.

HOW DOES IT WORK?

Extend™ works in clear, graphic terms. You build your model as a diagram of graphic object-oriented blocks logically connected together. Once the model is built, you double-click a block to view its dialog box and enter values. At any point you can run the simulation. The results are rapidly plotted and presented in tabular form. You can then easily change values or alter the model, run the simulation, and observe the results.

WHAT GIVES EXTEND THE REACH THAT OTHERS LACK?

- Transparent design: custom icons, object-oriented approach, dialog boxes for data input, and user defined on-line help.

- The power of a true scripting language: a full-fledged, professional application with a compiled, structured language and more than 150 built-in functions.

- A use level for everyone: work at three levels of sophistication:

    1. entering data into existing models;
    2. building models from libraries of blocks;
    3. developing new blocks.

- Accessibility of the Macintosh: easy-to-use graphic interface, multi-tasking with MultiFinder.

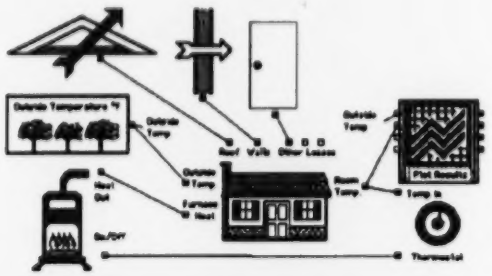
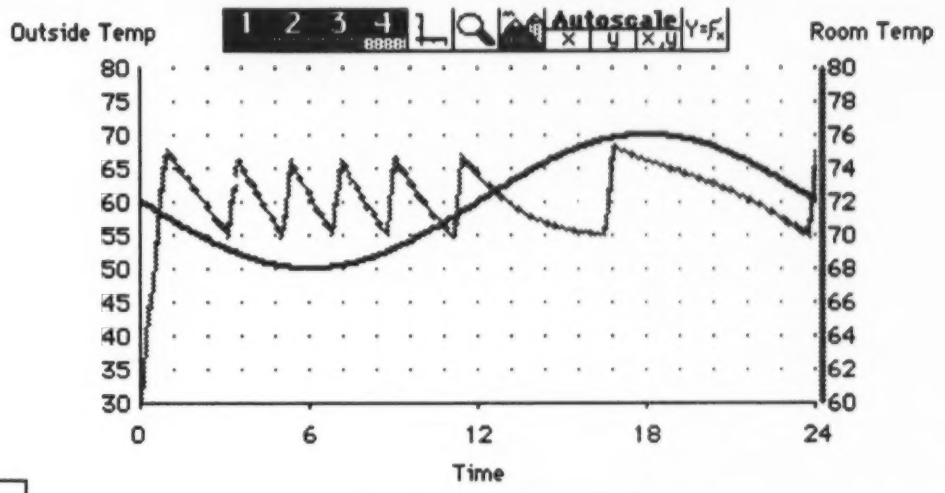


Figure 10.9 Home Heating Simulation (An example of Use Level #1: entering data into existing models.):

This model highlights Extend's user interface, and illustrates how users can change parameters in dialog boxes and run models which were set up by someone else.

The Home Heating file is a simulation of the heating system of an 1875 square foot single-story house. You can evaluate the effect of different construction materials and different levels of insulation on the operation of the heating system, under a variety of outside temperature conditions.



Time	Outside Temp	Room Temp		
0	60.00796	60.0001		
0.1	59.74632	61.77143		
0.2	59.48486	63.5157		
0.3	59.22374	65.2333		
0.4	58.96316	66.92457		

Figure 10.10

You may have noticed that the home we simulated above had no windows. You can select a window block from a library and add it to the Home Heating model. The small squares accompanying each block are called connectors - input connectors are hollow and output connectors have a heavier border. When an Extend simulation is set up, you can run through a whole series of variables, and see what the results are.

Many types of simulations can be achieved, and then presented to students to work out the best conditions for a specific situation. These include everything from what happens to fish in a pond when Piranhas are introduced (a decidedly drastic decline until they run out of fresh fish!) to how much power a power station needs to survive if a new city is put 'on-line'.

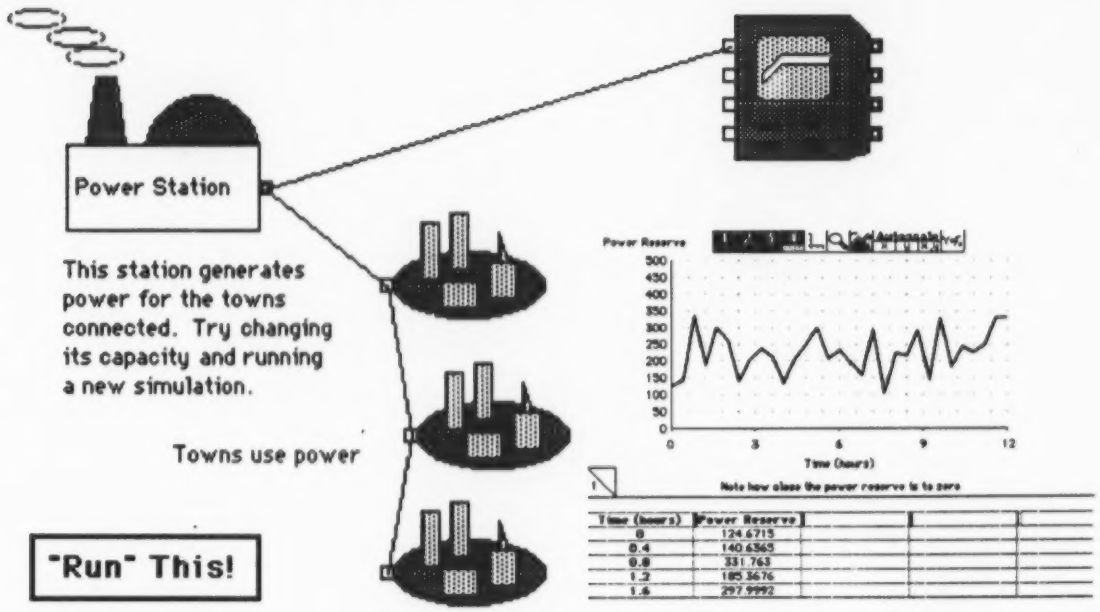


Figure 10.11

The primary tool for people who work in CAI (Computer Aided Instruction) is the software package Authorware Professional. Previously known as Course of Action, at a very basic level it shares some common features with HyperCard, and with lesser known hypertext applications such as Guide. The key shared features include:

- flexibility to design the graphic images that will be the user interface for a particular application;
- the possibility of rich connections between items of information in a database;
- the ability to link to other software applications and sources of input (such as CD-ROM or video).

One of the things that set Authorware Professional apart from similar applications is a flow chart. The time-consuming stage in developing CAI is planning the steps, deciding what should appear to the user and when it should appear. The flow chart in Authorware Professional allows the whole CAI project (or just a section of it) to be planned in overview. As the plan is laid out, icons from a menu are inserted into the flow chart at points where the actions are to occur. Placing these icons brings in the underlying code to implement the actions. If, for example, the application developer wants to use animation, or show part of a videotape, then placing the appropriate icon provides the cue for that action to take place.

Figure 10.12

Programs such as Authorware Professional also allow students and teachers to interact in a very positive sense. The CBT designed modules allow students to keep a record of their skill levels, teachers to evaluate their students work (and the success of their own materials), and a time record of who did what when. The uses of Authorware Professional are as many and varied as Hypercard, but they embody a sophistication, a facade of reality and depth of curriculum research that place them much higher in complexity and effectiveness. The following examples (courtesy of Rob Hall of MacWorld) show the range of learning packages using CAI.

The warning alarm rings, the maintenance crew stand intent as the tensioned ribbon of paper begins, at first slowly, and then at a thundering pace, to wind through the press. In seconds the huge rolls of newsprint are being transformed into a cascade of collated and folded newspaper. The air is full of the sound of the presses. Suddenly, the operator notices a problem with the ink feed, the paper is being smeared with ink somewhere in the press. Damaged, unsaleable papers are spewing from the end of the line. The faster the press can be stopped safely, the less paper will be ruined. Everything depends on the alertness and skill of the operator.

Across the city, the light from the early winter sun slants across Peter Fury's desk as he picks up the first coffee of a twelve cup day. As the sun moves around the world, financial markets have opened and closed, and now the sun is shining in Australia. Fury is a senior executive of one of the major banks in Australia, and it is his job to monitor and direct the fortunes of that large enterprise. On the computer screen beside his desk are graphic 'buttons', each button carefully crafted to look three-dimensional and metallic, even down to the shiny patina from repeated use. He touches the button marked 'financial', and is instantly linked into the corporate database housed in the mainframes floors below his office.

At the same time, in an industrial plant a young apprentice is being shown the correct angle to hold a hand saw when cutting timber. The morning resonates to the sound of the saw strokes.

Using the flexibility of the AuthorWare Professional software a course designer can record details of student participation, success rates and when (and how long it took) for the student to complete the unit.

Apprentice tool identification training

Student	Logged on	Time	Measuring tools viewed	score	Cutting tools viewed	score	Nailing tools viewed	score	Total score
Garry Benson	15:29	2 min.	Yes	100%	Yes	100%	Yes	100%	100%
Leo Smith	10.08	2 min.	Yes	50%	Yes	75%	No	-	44%
SRK K	11:52 AM	2 min.	Yes	100%	No	-	No	-	22%
Garry B	12:56 PM	2 min.	Yes	50%	No	-	No	-	11%
Ivar Stanelis	3:45 PM	4 min.	No	-	No	-	No	-	0%
8 9	3:50 PM	1 min.	Yes	50%	Yes	25%	No	-	22%

This ability to design an interface which fits both the culture and the needs of different organisations is based on the ability to use 'visual language' and images that the users are comfortable with, while the software allows information to be drawn from many underlying data sources. However, as in all cases of CBT or CAI, the primary need is for the expert educational analysis of course aims and objectives to be carried out before the applications are even commenced. Even simple courses (such as the one illustrated below which looks at photography) demand specific objectives and feedback for student learning.

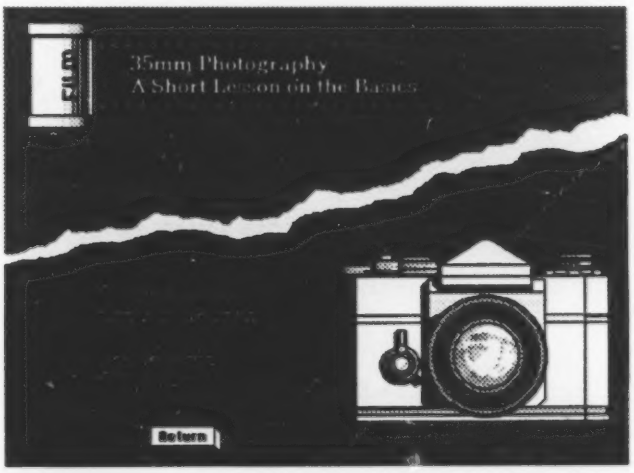


Figure 10.13

The trend towards multi-media based CAI courses with a user-friendly interface will have far-reaching implications for all TAFE courses throughout Australia. These interfaces need not be limited to stand-alone or networked PCs such as the Macintosh and IBM systems (which can also use AuthorWare Professional). The use of mainframe computers with appropriate workstations (which can include Macs and IBM systems) are now being used widely in TAFE colleges and universities throughout Australia.

CML (Computer Managed Learning)

In the present climate of financial restraint, education will continually be asked to accomplish more learning with fewer resources. When business and industry are faced with this predicament, they usually automate. Colleges and universities now have to do the same. Education is highly labour intensive - usually more than 80% of recurrent funding goes to personnel costs. This has hastened the introduction of Computer Managed Learning, as existing staff have to contribute to more learning resources.

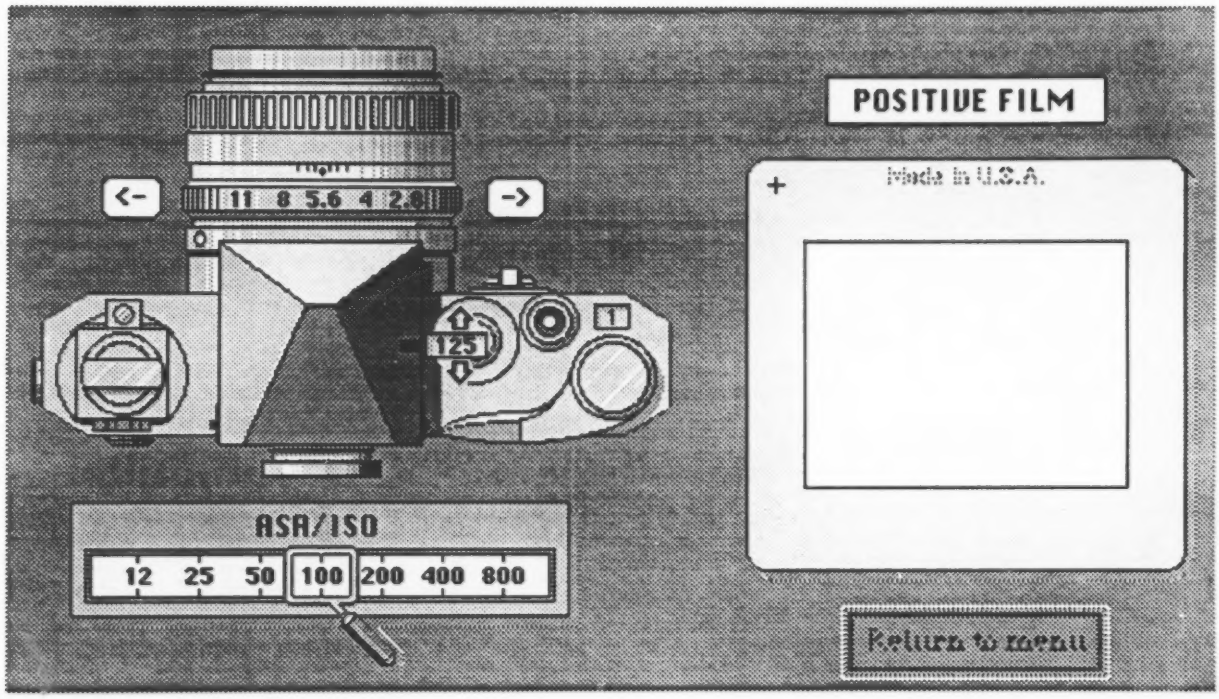


Figure 10.14

The TAFE College of the future will make the role of the educator even more important and more challenging than it is today. Educators should be assisted in reorganising their work so that much of the time-consuming paperwork and record keeping can be relegated to the computer, freeing more of their time for student interaction.

Computers supply a sophisticated, integrated library of software systems that aid lecturers in:

- Building an inventory of courses, sequenced into comprehensive programs.
- Developing, delivering, and analysing diagnostic tests.
- Evaluating individual and group performance.
- Evaluating curriculum.
- Maintaining student records.

CML allows many educational choices:

competency based - non-evaluated

CML is designed for 'outcome' or 'competency' based training. Students are evaluated by the College's standards:

individualised instruction - classroom format

The choice of individual instruction or training for groups is up to the teacher, or a combination of the best of both methods may be appropriate. This also means that it is easy to respond to diverse schedules and levels of knowledge.

outreach capability - classroom instruction

Instruction can be accessed by anybody with a PC and a modem, anywhere in the world, at any time of day or night, at their own learning speed.

In a typical system, both students and instructors access the computer using video terminals and printers. The students receive assignments and related information on course organisation. All testing can be done via the system. For the instructor, computer managed learning provides basic course organisation, easy communications with students for assignments and messages, and fast retrieval of student records for analysis of both individual performance and overall course performance.

In closing, there are many advantages which CBL, CAI and CML offer TAFE educators, students and administrators. They are:

Educators

- More time for teaching
- Valid/reliable testing procedures
- Automatic detailed record keeping
- Immediate identification of student difficulties
- Easy access to enrichment/remedial materials
- Automated issuing and marking of student assignments

Students

- Better access to instructors and learning resources
- Builds confidence through immediate feedback on tests and assignments
- Opportunity for individualised education plans, as courses can adapt to every knowledge level, learning speed and learning style.

A good example of this is a Triage course based on CD.ROM which is used to train emergency medical teams in the USA, without losing lives in the process.

Administrators

- Teaching supports institutional goals.
- Cut dropout rate by early identification of students at risk.
- Standard curriculum and testing procedures.
- Improve student learning diagnostics.
- Enhance instructor efficiency.
- Uniform tracking through the institution.
- Constantly assess progress.
- Maintain highest quality instruction.
- Easily monitor course effectiveness.

11. VIDEO CONFERENCING

Video conferencing is one of the newest teaching technologies available, and potentially one of the most exciting. The material in this section has been adapted from a description of the trial video conferencing network established between Adelaide College of TAFE and Light College of TAFE in 1990. The material was provided by John Heneker, Director, Light College, and is used with his permission.

DESCRIPTION

Video conferencing technology allows people at remote sites to realise the benefits of face-to- face meetings without actually having to travel. The sites used in the initial trial in South Australia are relatively close, but the technology to link more sites, and those further apart is available. The diagram shows the geographic locations of the first three trial sites.

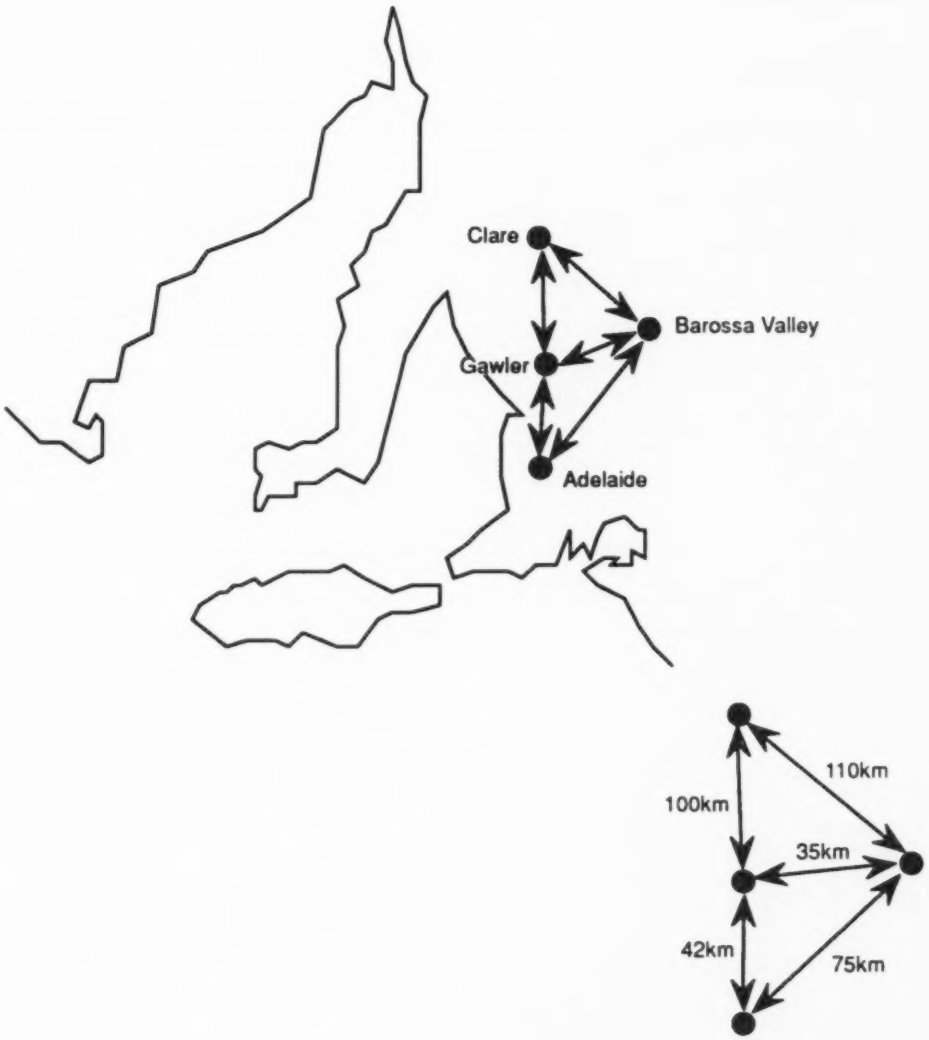


Figure 11.1

THE TECHNOLOGY

The equipment in use allows the digital transmission of live, two way television between Adelaide College of TAFE and two campuses of the Light College at Clare and Nuriootpa. It has been found that it is possible to set up domestic quality video cameras in the classrooms, which only need to be carpeted and have reasonable acoustics and lighting, and beam the lesson live between the locations. Students in the distant locations can see the lecturer and participate in the lesson, and the lecturer is able to see and talk to the students at the other sites.

The two key technological inventions which make this possible are:

- a codec, which converts the analogue signal from the camera into digital for transmission and decodes the digital signal back to analogue for reception.

- a digital device enabling large volume, high speed transmission.

The codec is state-of-the-art technology. Its first major demonstration in Australia was on January 1st 1988, when it was used to transmit pictures live from Antarctica for the Bicentennial television special Australia Live.

For the first time, in the near future, there will be a single international standard for video compression techniques covering data rates from 64 to 2,048 Kilobits per second. Study group XV of the Consultative Committee, International, for Telephony and Telegraphy (CCITT) have met to apply 'accelerated procedure' to recommendation H.261 which describes the techniques to provide a standard way in which codecs will process a video bit stream. This will provide universal compatibility and connectivity of different vendor's video conferencing equipment.

A two megabit digital service, called Megalink 2, has recently been made available by Telecom. Megalink 2 is an integral part of the Telecom digital network, and it uses the individual or combined technologies of cable (including the new optical fibre cable network) and radio systems. The service can carry voice, video, facsimile and computer data. Its capacity is best described by the fact that it can transfer all of the words listed in the Concise Oxford Dictionary within one second.

Megalink 2 was initially designed to provide point-to-point transmissions, but Telecom is now developing multi-point systems. A video picture can be transmitted to up to four points in one direction, and Telecom engineers are now confident that, using appropriate switching equipment, three video pictures can be transmitted back to the original source and viewed as a 'split screen'. This multi-point, two-way video system using codecs, could soon be of international significance, especially in educational circles.

THE TRANSMISSION NETWORK

The transmission network for the trial was designed to be flexible and to be used in a variety of modes. The main mode was transmission between Adelaide College and both campuses of Light College. Normally, there would be students with the lecturer at Adelaide College, as well as students at both Light College sites.

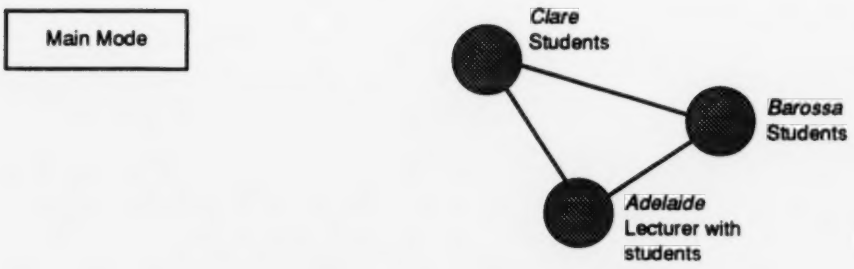


Figure 11.2

A slight variation allows a lecturer at Adelaide College to transmit to students only at the two Light College sites.

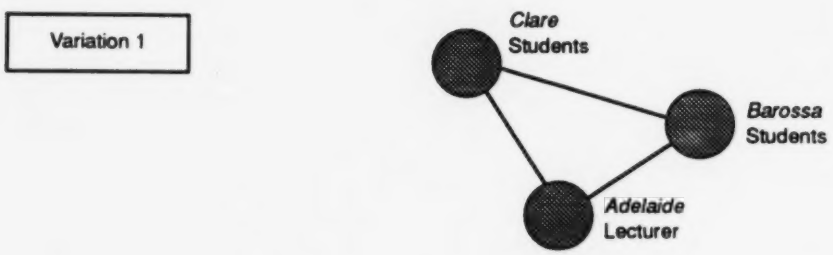


Figure 11.3

Another two modes allow classes to be delivered from one of the Light College sites to the other, but with the signals patched through Adelaide College.

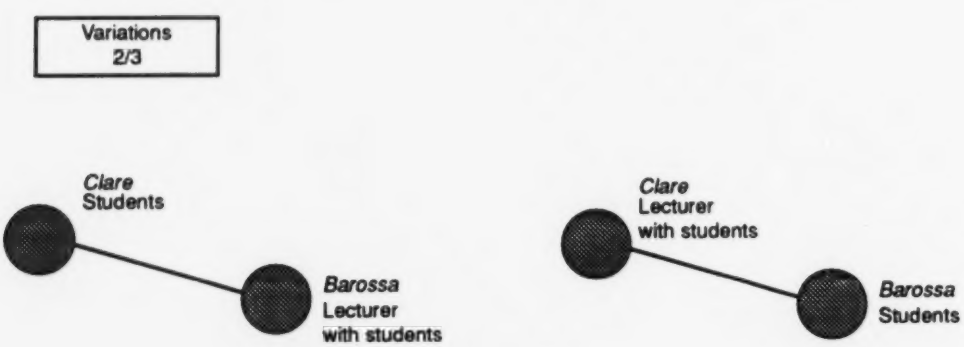


Figure 11.4

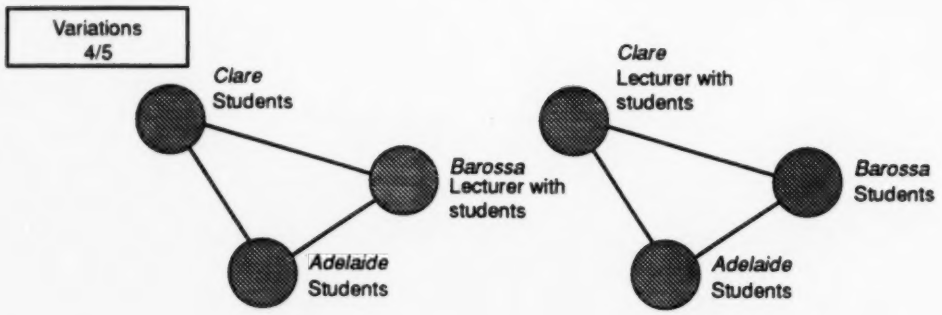


Figure 11.5

It was also possible for a lecturer to be based at either of the Light College campuses with students at both of the Light College campuses, and at Adelaide College (variations 4 and 5 above).

All courses were transmitted by live, two way television, allowing students and lecturers at all three sites to see and hear each other.

RESEARCH FINDINGS ON VIDEOCONFERENCING

Catchpole (1986) has had extensive experience in the use of one-way satellite and two-way audio delivery of courses in Canada. Some of the insights which he has into video conferencing methodologies include:

1. It is a sound distance education or open learning system.

   Catchpole believes that within a sound distance education system, television courses can provide students with increased opportunities for encoding/decoding, interaction and affiliation. Catchpole (1986) analysed the Knowledge Network's courses in British Columbia which were delivered by one-way satellite and two-way audio, and found that when such systems 'were integrated into a well designed distance education service' (p.129) the medium enhanced student learning in these three ways:

   > by fostering increased verbal and visual encoding, permitting immediate interaction with the instructor/tutor and providing a chance for affiliation with other learners. (p.129)

2. Benefits of interaction.

   Catchpole also believes that effective methodologies for interactive television courses enable the student to be actively involved in the learning process. These methodologies also provide maximum opportunities for the learners to use their range of skills.

   In the Adelaide College - Light College video conferencing trial the interactive nature of video conferencing was explored exhaustively, through encouraging the use by lecturers of techniques such as:

- syndicate work and report back mechanism;
- questioning;
- role plays;
- group discussions;
- presentations by students;
- case studies;
- group problem solving activities;
- feedback techniques.

3. Interacting with materials and people.

Catchpole (1986) hints at the double benefits of interactive television when he postulates that educational media can be categorized into three groups:

- verbal mode (print texts, audio cassettes, telephone links...);
- the visual (graphics, slides);
- those that do both (video-cassettes, television, computers with graphics, etc.) (p.130);

Catchpole also points to Piaget's cognitive psychology for theoretical justifications for the multi- sensory opportunities offered to the student by video-conferencing:

> According to Piaget's so-called 'genetic epistemology' one acquires knowledge not by simply storing copies of information in the brain but by assimilating information into one's current understandings of reality...Since everyone's scheme repertoire differs, it is very useful for learners to have a chance to interact with teaching materials (and teaching people!) in order that they may personalise their learning process as much as possible... Adult learners, particularly, bring very heterogeneous backgrounds... to the learning situation and thus may benefit from a chance to self-tailor educational inputs. This personalization of learning requires the ability to interact with learning materials - to be able to ask questions of materials and receive feedback (p.130).

4. Types of interaction.

To place video-conferencing in perspective as an interactive medium, Catchpole (1986) lists the types of interaction possible in conventional and distance education courses:

> Traditional methods for achieving this interactivity have included examination scores, written feedback, question periods in lectures and discussion groups. When one examines interactivity in distance education then telephone links to tutors, audio teleconferences, computer assisted learning and study guides...would all rate high in interactivity. Low interactivity would be texts, audio and video- cassettes and pre-recorded broadcast television (p.130).

5. Television literacy skills.

Catchpole (1986) notes that the success of interactive television is to a large extent dependent on 'the willingness on the part of the instructors/tutors to develop a new

set of television literacy skills' (p.129).

As part of the trial all participating lecturers were assisted in developing these 'television literacy' skills by staff from the Centre for Applied Learning Systems (CALS) at the Adelaide College.

6. Student's information processing systems.

Catchpole (1986), a psychologist and the regular presenter of his own psychology course on the Knowledge Network, argues that multi-media courses accommodate individual students' differences in learning styles and capacities:

> Those working in the field of distance education are in general agreement that multi- media systems are superior to those dependent upon a single channel...Multi-media courses provide students with a greater choice of encoding strategies. They are also consistent with research in cognitive psychology suggesting that we possess at least two... and possibly more parallel information-processing systems; and that inter - and intra-individual differences exist in the relative effectiveness of these systems (p.129).

The implications of this are that when you are using this medium, that you would be advised to use a variety of teaching methodologies.

7. Redundancy.

Catchpole develops this idea of providing students with extra opportunities by using the concept of 'redundancy':

> Clearly then, it is epistemologically desirable to present to-be-learned material via as many learning channels as possible, and to deliberately build in a certain amount of redundancy within and among channels (p.130).

REFERENCE

Catchpole, M. (1986). *A guide to producing and hosting a live-interactive telecourse* in Distance Education, Vol,7, No.1, pp 129 - 142.

GLOSSARY OF TERMS

A3, A4, A5	Paper sizes
Ambient light	Light in a room which comes from the existing surroundings.
Aspect ratio	The width of an image in relation to its height. For television, the ratio is 4:3. For 35 mm slides, it is 3:2.
Attenuate	Reduce the amplification of a signal.
Audio	Electronic reproduction of sound in a recording. For the human ear, the frequency range can be from 20 - 18,500 Hz and varies with age.
Authoring language	Computer language which is specifically designed for computer managed learning.
Backing base	The flexible material, usually cellulose acetate or polyester, which carries the magnetic iron oxide coat which 'records' the taped signal.
Background	Anything beyond the main area of interest in a picture.
Broadcast	Transmission of electronic signals by radio frequency.
Bridge	A device which links more than two telephones together, so that a teleconference can take place.
Bulk eraser	Device for erasing or wiping tapes quickly by passing them through a strong electromagnetic field.
Burn-in	Image imprinted onto pick up tube of television camera by pointing the camera at a bright light source for too long. The burn-in will appear on all subsequent shots.
Camera script	A final television script, including all technical directions. Generally, the audio directions will be on the right hand side of the page, and the vision directions will be on the left.
Caption	Printed matter or artwork, usually superimposed over a part of the screen.
Cardioid	Microphone with a heart-shaped pickup pattern.
Close-up	Tight shot of subject - usually just head and shoulders.
Coaxial cable (coax)	Shielded cable used for the transmission of radio frequency signals and also for video and sync signals.
Column width	The length of the line of printed words. May be measured in either standard linear scale or by number of characters.

Compatibility — The ability of the equipment to be interfaced, i.e. linked together, and still yield good results.

Computer Assisted Learning (CAL) — Is an interactive instructional technique in which a computer is used to present instructional material, monitor learning, and select additional material in accordance with individual student needs.

Computer Based Assessment (CBA) — Involves the use of a computer to generate and score assessment competency tests for particular course components.

Computer Based Learning (CBL) — Embraces the total concept of computer usage in the delivery and management of student learning. CBL incorporates Computer managed learning (CML), Computer assisted learning (CAL), and Computer based assessment (CBA).

Computer Managed Learning (CML) — Involves the use of a computer to maintain and analyse data on student performance and instructional progress as an aid to educators or students in selected learning activities.

Content editing — Editing with particular attention to the content. For example checking that facts are accurate or that explanations are clear.

Copy editing — Editing with particular attention to the basics of language like spelling, punctuation and grammar.

Credit — Acknowledgement in sound or vision of a person's contribution to a programme.

Cue — Agreed visual or audio signal to commence an action.

Cut

(1) instant switching from one camera to another in the vision mixer.

(2) end of one shot and the beginning of another in the editing process.

Data compression — A method of coding information to speed up facsimile transmission.

Decibel — Abbreviated 'dB' or 'db' , it is a relative measure of sound intensity or 'volume'. One dB is about the smallest change in sound volume that the human ear can detect.

Desk top publishing — The use of sophisticated word processing or desk top publishing computer packages by authors to produce text that is ready for direct copying onto printing masters.

Dolby — An electronic device or circuit which reduces the amount of tape noise (principally tape hiss) introduced during the recording process. It does this by boosting - in carefully controlled amounts - the strength of weak signals before they

are recorded. During playback the signals (and the noise) are cut back by an exactly equivalent amount. The original dynamics are thus restored, but the noise is reduced by 10 to 15 dB.

Draft — A complete version of a text which you are writing. A first draft still needs re-reading and re-writing. A final draft has been through both this process and editing.

DUCT — Acronym for Diverse Uses of Communication Technology. The brand name for a particular device which allows several people at the one site to share in the use of a single telephone.

Dub — Copying taped signal from one audio or video tape recorder to another by electronic means.

Duplex — Two way simultaneous communication. Full duplex allows simultaneous transmission and reception of data to and from different locations by the same terminal.

Editing

(1) The selection and organization of visuals after filming and the refinement of narration or captions.

(2) Reading through a text with a view to correcting errors or improving expression.

Erase — Removing of information from magnetic tape.

Establishing shot — Orientation shot, often a long shot, which gives the viewer an idea of the whole scene in which the action is to occur, or establishes the mood.

Fade — Increase or decrease in vision and/or sound.

Fax — A facsimile machine which sends copies of documents via telephone lines.

Flutter — Very short, rapid variations in tape speed, causing pitch and volume variations which were not present in the original sound. A form of distortion.

Font — The style of the lettering.

Frequency — The repetition rate of cyclic energy, such as sound or alternating electric current, expressed in cycles per second (hertz or Hz), or thousands of cycles per second (kilohertz, kHz). By convention, 'bass' frequencies in music extend from about 20 to 200 Hz. 'Treble' sounds are at the high-frequency of the sound spectrum, and may extend from 2 to 3 kHz to the frequency limit of audibility (about 18 to 20 kHz). 'Middle' (or mid-range) frequencies occupy the remainder of the spectrum, from 200 Hz to about 3 kHz.

Graphic design	The planning and design of all those things which affect the appearance and readability of a text.
Graphics	Non-verbal material in your text including pictures and diagrams.
Grey scale	The number of distinguishable grey tones between black and white.
Head alignment	Includes all mechanical adjustments necessary to assure proper spatial relationships between the head gaps and the tape or, more specifically, a properly recorded tape track.
Headroom	The space on the screen between the top of the frame and the top of the subject's head.
Hiss	A sibilant sound, most often found in tape recording or playback. The better the tape system, the lower the hiss.
Interactive computers	Computers which are linked together in such a way that their users can work together on the same task.
Justifying	Aligning your text to a left, right or central axis.
Keystone distortion	Horizontal or vertical distortion of a projected image. Caused by not having the projector aligned to the screen.
Laser printer	A printer in which an electronic beam 'etches' images onto a photoelectric drum which then transfers the high quality image to paper.
Landscape	A page format in which the width is greater than the height.
Learning centre	A room which is set up with the basic information and communication technology necessary for its users to tap into a wider educational network.
Level	Signal amplitude relating to either sound or vision, as measured on a standard scale. Levels should be checked and adjusted before the performance.
Lip sync	Sound and picture recorded or playing simultaneously.
Loud speaking telephone	A telephone with a loudspeaker that makes an earpiece unnecessary and which allows more than one person at a time to hear the incoming message.
Master	First generation tape, or first edited version. Used for making copies.

Microcomputer	A self contained computer, comprising a keyboard, and a memory and which is attached to a display screen and possibly a printer.
Microphone	Device for converting sound waves to electrical energy.
Mixer - audio	Audio control console for mixing sound sources.
Mixer - video	Video control console for selecting or combining video signals.
Modem (Modulator - demodulator)	A device which permits information to be transferred between computers using telephone lines.
Monitor	A video display unit which receives its picture and sound inputs from line inputs.
Negative image	An image where lights and darks are reversed to achieve special effects.
Network	Two or more pieces of information or communications equipment which are linked together.
Noise	Unwanted electrical signals in either the audio or video signal produced by electronic equipment.
Pan	Pivot the camera head either right or left in the horizontal plane.
Patch cord	A wire used to connect two pieces of sound equipment together, so that electrical impulses can be transferred between the units.
Persistence of vision	A property of the retina of the eye which causes it to remain excited by an image for about 1/30th of a second after the image has disappeared.
Point	The unit of measurement of the size of the letters in printed text.
Portrait	A page format where the width is less than the height.
Print through	The transfer of magnetization of recorded sound from one layer of tape to immediately adjacent layers of the wound tape. Print through is usually encouraged by overloading during recording. The audible effect of print through is echo.
Projection axis	An imaginary line drawn through the centre of the aperture and lens to the centre of the image.
RAM (Random Access Memory)	Computer memory content which can be altered, but which disappears when the computer is turned off.

Reading gravity	The tendency of the reader (in English) to scan the page from top left to bottom right.
Receiver	Home-type television set which receives RF (radio frequency) signals.
Receiver/monitor	A video display unit which can display signals received either from broadcast (RF) or from direct line inputs.
RF	Modulated video, audio and sync signal. RF signal is used to broadcast television through the atmosphere. Television receivers are designed to decode the RF signal.
RF Converter	A small device to encode video and audio signals to RF so that they will play on a normal television receiver. RF converters are included in home VCR's.
ROM (Read Only Memory)	Computer memory content which cannot be altered.
Scanning	Movement of the electron beam in the video tube from left to right, top to bottom.
Script	The specific directions for picture taking or art work in the form of a listing of scenes with accompanying narration or captions.
Signal-to noise- ratio	The voltage ratio, usually expressed in decibels, between the loudest undistorted tone recorded and reproduced by the recorder and the noise reproduced when the audio signal is reduced to zero.
Snow	Random black and white dots shown on a television screen. Can be due to poor reception or to dirty video heads. It's the 'picture' seen on erased tape and tapes which have never been recorded on.
Software	A program for use with a computer.
Splice	Mechanical join between pieces of film or tape.
Story board	A series of sketches or pictures which visualize each topic or sequence to be produced in an audiovisual presentation. The audio content will also be listed.
Style	The distinctive way in which you use words when you write.
Superimpose (super)	Electronic overlapping of two or more pictures on the screen.
Sync	Electronic timing pulses which control the recording and replay of the video image.

Talent	Term used for all performers and actors.
Tape	Iron oxide coated mylar plastic that will record picture and/or sound information when magnetized by a tape head.
Teleconference	The linking together of two or more sites by telephone.
Telephoto	Lens designed to narrow the field of view and to enlarge the subject, with a focal length which is longer than usual. Used for close-ups which must be shot from a distance.
Tilt	Move the camera in the vertical plane, i.e. up or down.
Track	The path on the magnetic tape along which a single channel of sound is recorded.
Transceiver	A single facsimile machine which can send and receive information.
Thumbspot	A visible mark placed on a slide, which indicates its correct position in a slide tray or magazine.
TTY	Acronym for "teletypewriter" which is a device for printed communication using telephone lines. It is of particular value for communication with the deaf.
Video	Picture component of a television signal.
Video tape	(1) electronic method of recording both sound and vision onto magnetic tape. No processing is necessary and the recording is capable of immediate replay. (2) magnetic tape used to record both sound and vision.
Voiceover	The voice of the narrator or other subject used without the accompanying image of that person.
VCR	Video cassette recorder. Records video, audio and sync information onto video tape.
White balance control	Video camera setting to adjust colour rendition of a scene for the particular lighting conditions.
Wow	A form of distortion in sound reproducing systems caused by relatively slow variation in the speed of the tape and characterized by its effect on pitch.
Zoom lens	A lens with a moveable element which enables the selection of various focal lengths.